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The United Verde and Pacific Railway.

This road is the subject of a paper read before the Montana Society of Civil Engineers on Feb. 9, by E. H. Becker, and published in the *Journal of the Association of Engineering Societies* for February. There is a good deal of interesting information about the organization and conduct of the work which we must omit for reasons of space; but the paper is well worth reading in full.

This is a 3 ft. gage railroad, 26 miles long, lying along the easterly and northerly slopes of the Black Hills of Arizona, near the center of Yavapai County. Its eastern terminus is the United Verde Copper Co.'s works at the town of Jerome, its western terminus Jerome Junction, a connection with the Santa Fe, Prescott & Phoenix Railway. The road was built by Mr. W. A. Clark as a private enterprise, for the purpose of transporting the mine products from the mine and furnishing supplies to it. It has besides some slight public traffic.

The mines are at an elevation of 5,500 ft. above sea level. The Santa Fe, Prescott & Phoenix Railway is 17½ miles from Jerome by air line. At first, transportation from the mines was had by wagon road to the Atlantic & Pacific at Ash Fork, then the nearest and most practicable point within reach. This means was found too expensive and inadequate, especially since an annual rainy season in July and August made the road useless for weeks at a time. In 1891 the Link Belt Engineering Co. undertook to build a cable tramway over the mountain from the works to the west side, and to deliver and receive freight at the foot of the western hill, from which point there was a comparatively easy and good wagon road to the railroad 12 miles away. Later this road was to be replaced by a branch railroad. This system of tramway consisted of towers or posts every 20 ft. carrying two rails on a cross arm. Travelers to which were suspended buckets, boxes, etc., were placed on the rails every 100 ft. and connected by cables which passed around drums at the ends and at angles. This tramway did not give satisfaction, being entirely inadequate to the service required, and it was therefore decided to build a railroad. The wagon haul heretofore had been \$8 per ton. The tramway and proposed branch railroad would probably have reduced this cost to about \$4 per ton.

There was little danger of making the road unprofitable by reason of excessive cost, when there was a possible limit of \$4 per ton to be expended in operating expenses, maintenance and interest charge in transporting 100 tons daily a distance of 23 miles. One dollar per ton or \$100 a day would be sufficient for maintenance and operating, which would leave \$9 per ton, or \$900 per day, for interest charge. This sum, capitalized at 6 per cent., shows that over \$50,000 per mile could be spent in construction and equipment.

This might be the way to figure if the railroad were to be permanent, with growing traffic. The life of the mine being unknown, however, it might be abandoned within 10 years. Therefore, it would be unreasonable to construct and equip a first-class road for 20 daily trains when the present business would require but one. In view of these conditions it would be fair to assume that the price per ton should contemplate the refunding of the capital expended in a period of 12 years, as the probable time when the proposed road would reach the end of its usefulness. Four dollars per ton would provide for maintenance, operation, interest on capital and refunding of capital in 12 years with a construction cost of \$35,000 per mile.

The engines and grades were so proportioned to the traffic that one crew would be able to do the daily work with one trip a day if possible, although the mileage would not prohibit two trips if they became necessary.

Much attention was given to the question of gage. Many of the arguments for and against narrow gage as compared with standard cannot be expressed in money value. The narrow gage allows cheaper construction by

reducing heavy grades, high, expensive, bridges, and making possible sharper curves on the mountain side. The roadbed is narrower, the bridges lighter, the rails, ties and fastenings cheaper. On the other hand, by using principally cars of other roads the standard gage equipment would cost less than the narrow gage. The standard gage engines might cost 20 per cent. more for the same service, but it would probably be economical to purchase engines capable of doing 50 per cent. more work at an increased cost of 30 per cent. Again it is more expensive to maintain a narrow gage road by reason of the greater amount of curvature, but less expensive on account of the lighter track material and rolling stock. Altogether the maintenance expense is probably less on the narrow gage.

A disadvantage of the narrow gage is the necessity of transfer of cargo at the junction of the standard gage road. The incoming material is mostly coke and coal. By unloading these cars into bins and drawing the coke and coal out into narrow gage cars, the handling is reduced to a minimum. The outgoing product, metal and bullion, must be handled once extra, which can be cheaply done, since it is in sacks.

The use of foreign cars on such a short road would show a car mileage balance against the road at all times. The few cars owned by the road would be away from home, widely scattered, and probably standing on side tracks, earning no mileage (unless the per diem system came into practice) nine-tenths of the time. By using broad gage and foreign cars, the car-repair account would be largely increased. The old cars of other roads are always finding their way to small roads, in out-of-the-way places, where they undergo repairs before returning home.

The clerical force for the short narrow gage road is rendered much less by dispensing with all the help usually employed in the car accountant's office.

As it was possible to do the required daily work with one crew on either gage there would be no material difference in cost of train service.

While no careful location for a standard gage road was made, sufficient data were obtained to show that the cost of roadbed, bridges and track material would be increased not less than 80 per cent., or reduced to the cost of hauling the traffic, would add an interest charge equivalent to 20 cents per ton.

The difference in elevation between the termini is about 900 feet. It would have been possible to make a descending grade from the mine to a point on the Santa Fe, Prescott and Phoenix Railway, by passing around the mountain with a great loss of distance. To pass around the great ravines which occur frequently in the mountain sides would require a detour of over a mile to advance less than one-fourth the distance. It was easier to cross these ridges near the point where they joined the body of the mountain. The selection of these places to give the shortest line and cheapest construction gave some undulations to the grade not otherwise necessary. So long, however, as the maximum grade was kept down so as not to affect the handling of the daily business with one train this feature was not considered very objectionable.

The probable grade determined somewhat the selection of the engine. The sharp curvature demanded a short wheel base. An adjustment of these factors of grade, curvature, etc., was considered so as to produce the most economical engine capable of doing the work required. This was a mogul engine with a 9-ft. rigid wheel base able to do the required work on the 3 per cent. grade, and which would pass over curves of 100 ft. radius. The limiting radius, however, was made 146 ft. except in one instance of 162 ft. of track with 130 ft. radius. This sharp curvature was needed in crossing the ridges without excessive cuts or tunnels, in crossing the gulches without using very high bridges and in conforming the line closely to the hill sides. For fully one-half of the 13.66 miles on the mountain the natural slopes were not flatter than 2 to 1, and for the balance there were few places where it was flatter than 3 to 1. Therefore 40 deg. curves gave cuts, at the crossing of ridges, 10 to 25 ft. deep (in one case 48 ft.). In the same way bridges at the gulches were from 25 to 48 ft. in height. Excavations in the mountainous portions amounted to 110,000 cu. yds. against 150,000 cu. yds. of embankment. There was practically no waste excavation. The comparative length of cut and fill on the center line for the entire distance are 47,430 ft. cut, and 20,500 ft. fill, omitting the 3,350 lineal ft. in bridges. The grading in the valley amounted to 4,000 cu. yds. per mile, exclusive of terminal grounds. The roadbed here was principally in embankment. On the mountain, the work averaged per mile: earth excavation, 500 cu. yds.; loose rock, 2,000 cu. yds.; solid rock, 5,500 cu. yds.; ballast (in the excavation only), 1,000 cu. yds.; and borrow, 1,000 cu. yds. making a total of about 10,000 cu. yds. per mile.

The country was so rough that upon the mountainous portion of the line a location party of 11 men made a progress of only about one-third of a mile a day. The alignment gives an average of 727 degs. of angle per mile and the average length of tangent 166 ft. There was no water near the line, except at the ends, and the greatest difficulty was experienced during the progress of the work, it being necessary to transport camp supplies and water on the backs of burros at a cost of \$5 a day.

The maximum grade (3 per cent.) was equated for curvature at the rate of 0.03 ft. per degree. As the curves were very frequent, with short tangents between, often less than 100 ft., the compensation for curvature was dis-

tributed so as not to make changes of grade for distances less than 300 ft.

In one instance 4,700 ft. of line might have been saved by the building of a tunnel; \$7,000 was spent in grading the longer line around the hill. This was made necessary by the extremely high cost of timber which would have been necessary as a lining for the tunnel. All such timber would have had to be packed to the work.

The roadbed was made 12 ft. wide at grade in cuts and 12 ft. wide on top of embankments. Excavations were ½ ft. below grade for ballast. The material was mostly rock. Six inches of broken stone were put in by the grading contractors as ballast.

Nearly all the material for bridges was hauled to the site ahead on the grade. The bridges were mostly trestle bents on subsills, with spans of nearly 16 ft. excepting at a few places, where piles could be driven. The pile bridge had three piles to the bent, with 14-ft. spans. The trestle bents had four posts (two batter and two plumb) under a 10-ft. cap of 12 x 12 timber. There were six stringers, 7 x 16, to the span. Bridge ties were 6 x 8, 12 ft. long, spaced 15 in. centers, and a guard rail 5 x 8 was dapped down on the ends of the ties. The posts were of round timber, standing on flattened sills.

The rails were 45-lbs. on the mountain and 40-lbs. in the valley work. Suspended joints and 24-in. angle bars with four holes were used. The switch material was all designed for the 40 lb. section, the yards being laid with that rail. Five rail braces to the rail were used on the outside rail of all curves, and guard rails were placed on the inside of the inner rail on all curves of 30 deg. or over. The rails were laid with broken joint. Seventeen ties to the 30 ft. rail were used on curves, 15 on tangents.

The road has two Baldwin compound mogul engines, of which some of the features are: Two cylinders, 10 in. in diameter; 2 cylinders of 17 in.; stroke, 20 in.; drivers, 41 in. diameter; driving wheel base, 9 ft.; engine wheel base, 15 ft. 5 in.; weight on drivers, 60,000 lbs.; engine in working order, 70,000 lbs.; capacity of tender, 2,000 gal.; weight of tender loaded, 36,000 lbs.; train load, 120 tons behind the tender on 3 per cent. grade. There are 15 flat cars, 24 ft. long and 7 ft. wide, with platform 3 ft. 8 in. above the rail; some of these will probably be changed to coal cars; they were needed for construction work. There are 10 coke cars, 2 box cars and 6 coal cars, the latter with drop bottom and side gates, all of the same length, width and height as the flat cars, with 28-in. wheels. Freight cars have a capacity of 20,000 lbs. There is one combination coach 30 ft. long and 8 ft. wide. All cars have Westinghouse air brakes and Janney couplers. The couplers work nicely on the crooked road.

Along the road there are 34 bridges comprising 332 spans with a total length of 4,836 ft. Their average height is 28 ft. The maximum height is 50 ft.

The curvature on the line presents some interesting features which are shown in the following table:

Total length of line covered by curves.....	72,115 ft. or 13.66 miles.
Aggregate length of all curves.....	13,971 ft. or 2.62 miles.
" " tangents.....	28,150 ft. or 5.33 "
Average " " curves.....	234 ft.
" " tangents.....	166 ft.
Longest curve is 15 deg. or 960 ft.	
Largest angle is in a 30-deg. curve, 162 deg. 51 min	
Longest tangent is 657.5 ft.	
Average curve extending over entire line would be 13 deg. 46 min.	
Average curve extending over curved portion of line would be 22 deg. 35 min.	
Greatest deg. of curve 450 deg.	

The cost of the road in working order, including equipment, was approximately \$12,000 per mile. With a traffic of 120 tons per day, which will be the average for the next two years, the cost per ton was .833 cents. The interest charges on the entire outlay for construction are \$18,600, which is .425 cents per ton. The total cost per ton is \$1.25, or approximately 5 cents per ton mile. This figure seems rather remarkable in comparison with the rates at which the trunk lines of the country are doing business.

The line was completed and put into operation the first day of December, 1894.

The Railroad Situation in California.*

BY A CITIZEN OF CALIFORNIA.

Since 1850 over three hundred railroads have been projected for California and incorporated under its laws. The greater number of these schemes have been abortive; fifty-one or two of those of minor importance have been successful; nearly forty of these are operated either as proprietary or leased lines by the Southern Pacific Company. At present there are represented in California 18 railroads which are operated as separate properties, and have a total mileage of 4,628 miles. If the lines operated by the Southern Pacific Company and the Atchison, Topeka & Santa Fe be excluded the mileage operated by the remaining 16 corporations in June, 1894, was 830 miles. It is apparent that these 16 companies must be of only local importance, and comparatively insignificant as a factor in the transportation system of California. Of the 3,798 miles represented by the two inter-state corporations, 3,054 miles are under the management of the Southern Pacific Company, and 744 miles

* We have to thank Mr. W. G. Curtis of the Southern Pacific Company, for many courtesies and much valuable information on the subject; he has shown every desire and given every opportunity to have the situation represented in its true aspect. Mr. Spreckles and the Hon. John T. Doyle, directors of the proposed San Joaquin Valley Railroad, have also furnished indispensable data on the subject.

[The reader is referred to a discussion of the natural resources of California and the relation of the Southern Pacific in the development of the state, contributed by Mr. Richard Gray, General Traffic Manager of the Southern Pacific Company to the *Railroad Gazette* of August 26, 1892.]

under that of the Santa Fe. This condition of things has caused California to be known as the "one railroad State." That this has no parallel in any other part of the country is well known; it has also been appreciated to some extent that the conditions which have produced the present railroad situation in California have had no parallel. The situation is unique. The hostility of the people of one section of the State towards the Southern Pacific had its prototype 20 years ago in the states of the middle west. It is undoubtedly true that the present hatred of the people of California toward corporate capital has been disastrous in many ways to the best interests of the state and has destroyed confidence in the general commercial situation. The same conditions of trade which have induced, or rather compelled the smaller independent roads to amalgamate under the Southern Pacific Company, have also produced much of the present animosity and antagonism toward this company. In the following paragraphs an attempt will be made to trace the cause of this antipathy, to decide whether it is based on cause or is merely due to prejudice, and to elucidate in some way the paradox presented by the present movement in California of hard-headed San Francisco business men to build a railroad over three hundred miles long running from Oakland to Stockton, and from Stockton to Fresno, with its southern terminus at a point near Bakersfield, by contribution merely, not a bond to be issued, and with no hope of being able to earn a dividend.

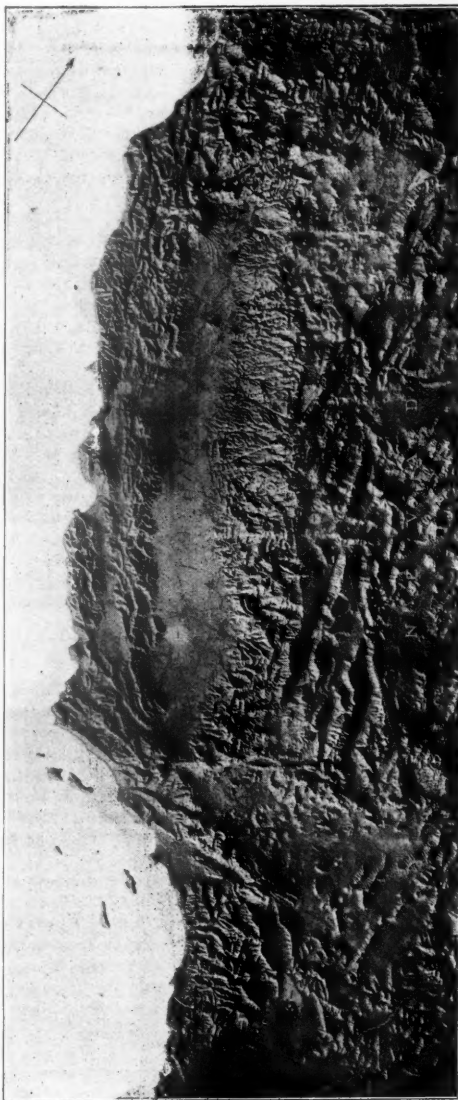
The people of the San Joaquin Valley, in California, would crucify the Southern Pacific Company if it had a personality. Every villainy is charged against its officers and so far as is known, they have never been credited with any virtue. California has been unfortunate in its railroad education. When the railroad problem reached its climax in the eastern states many men were prepared to take it up intelligently; for more than a quarter of a century railroad legislation had educated their statesmen in railroad matters. Their legislatures and boards of railroad commissioners were able to approach their investigations with some degree of acquaintance with the subject. This was not the case with California. Most of her railroad legislation had been attended to in Congress. When in 1877 the first Board of Transportation Commissioners was appointed by the Governor, railroad experts were very scarce. Much of the work done by this first board was inexact, and worse than all, it was "popular." It made misleading comparisons between the percentage which operating expenses bore to gross earnings in the Pennsylvania system and on the railroads in California, apparently unacquainted with the fact that such a comparison is valueless when the volume of tonnage is omitted from the exhibit. On the whole, these early boards did much in an unconscious way, to nourish the antipathy of the people towards the roads. They at the same time presented discussions only suited for roads having great traffic and quite irrelevant to roads doing pioneer work across the Sierras. On two separate occasions they went so far as to reproduce a translation of M. J. de La Gournerie's discussion of the law of gross earnings and net revenue which had been published by the *Railroad Gazette* some time previously. Later, when the railroad commissioners were elected by the people, the reports were filled with harangue and demagoguery, and continued so until the last five or six years. The most worthless verbiage interspersed with poetry filled the reports. Such headings to paragraphs as "The Mills of the Gods!" and "The Proposed Sponging Rebate on the National Subsidies" would be followed by "It was one of our first duties in the office to hold it and ourselves above the rot and rancor of the Punic war so long waged against an industry the very importance and magnitude of which had made it the tempting object of predatory attack."

In taking our leave of this office we do not bid adieu to California. We simply return to her jeweled hand the trust we have kept and administered in her name and interest. Bright, sunny-souled and altogether lovely as she is, good to the poor and just to the rich, fond of speed in man, horse and associations, and pretty fast herself, we will spend our days, sit up nights and stay with her to the end. . . . This is the evidence of the judicial power possessed by this Board of Railroad Commissioners, which, by the Constitution, was made a court of last resort on railroad matters in the state of California.

Despite the fact that the Railroad Commissioners have been uncritical and inexact in their methods, they have been far more temperate than those who have elected them. The people of California have been accustomed for many years to regard the railroad interests as the objective point of all legislation. They have demanded unjust laws and even confiscatory ones. This sentiment has been produced by the party demagogues who have made the railroad the scapegoat for all depressions in trade and financial stringencies. The inability of incompetent railroad commissioners to remedy the railroad situation has been ascribed to the free use of gold by the companies. The railroads have ever been the target of hostile legislation, and this desire to damage their interests has infected the residents of the country tributary to their lines.

Much of the present hostility can be referred to the industrial changes undergone in the state. The centers of population and production have changed. Within railroad times, the main industry of some sections has changed from mining to cattle raising, and on into farming, and finally into horticulture. San Francisco is one center of hostility. It feels that its commercial supremacy

on the Pacific Coast is being threatened by the existing railroad conditions. Before the advent of any of the trans-continental railroads it was the only distributing center, and justly so. Everything was brought by water, and it obtained the full advantage due to its



Relief Map of California, Showing Pre-Determined Transportation Routes.

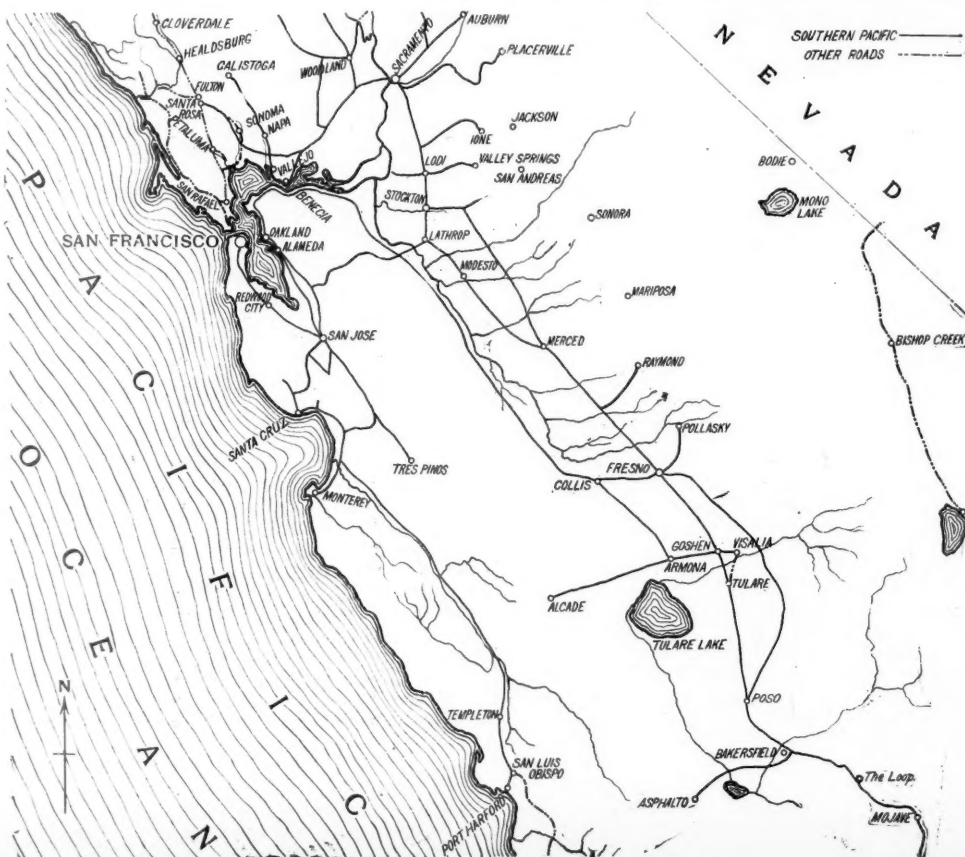
geographical position. But with the building of the overland roads, a disturbing element came in. A railroad may be considered for a moment as a natural highway; it influences to some extent the economics of transportation, just as any natural highway would do. San Francisco attained its supremacy under the old conditions. Considering its distance from central markets, as

measured by the cost of reaching them, San Francisco was nearer the East, by reason of its cheap water transportation, than was Ogden, or even Denver, whose distance, when measured by the cost of railroad transportation, became greater than to San Francisco. When the railroads were completed, however, this advantage ceased. The city began to assume the geographical position which belonged to it under the changed transportation system. Its distributing trade began to diminish. Other terminal points were established in the State, so that now San Francisco should be endeavoring to attract the trade of the Orient instead of attempting, by various devices, to compel the whole internal commerce of California to be tributary to it.

Between the interior towns, which are growing and prosperous, there is a rivalry which often shows itself in a desire to grow at the expense of competitors. They want to be protected against each other; the whole state has a tendency to desire protection against the other states, and it is demanded that the railroad should afford this protection. The manufacturers who have high cost of fuel and labor to contend with, complain that the railroad has made rates on imports so low that they cannot even supply the home markets. The exporter and the producer complain that the railroad rates make it impossible for them to ship their products into eastern markets and compete with the home-grown produce of those states. The local interior shipper in a pastoral region expects and demands the same rates per mile as are enjoyed by a place having ample water communication to do all its business. In all this complexity of demands the one most constantly reiterated is, "We want a competing railroad."

It is natural to inquire why there is only one railroad in California. For a quarter of a century one of the main overland avenues has been open. Railroad sentiment has been rife all the time, and yet this unusual and perhaps abnormal condition is the result. A short study of the geographical distribution of the productive lands in California will make it evident that the transportation routes are predetermined. (See photograph of relief map.) Running between the Sierra Nevada and the Sierra Morena mountain ranges is a valley of great fertility over 400 miles long and averaging about 40 miles wide. To the south this tract is known as the San Joaquin Valley, while the Sacramento Valley takes up the northern portion. They take their names from the navigable rivers which drain them. At each end the valley is closed by high mountains costly to cross and offering many great engineering difficulties. Between the Sierra Morena range and the Coast range, to the south of San Francisco, runs the Salinas Valley, nearly 200 miles long and about 20 miles wide. This valley is closed at the south end by the meeting of the bounding ranges. Only within the last year has a railroad, at great expense, crossed this barrier by a section of track 17 miles long, with heavy grades and six costly tunnels.

In 1866 the Southern Pacific Railroad Company was authorized to construct a road to run from San Francisco down the San Benito Valley to meet the Atlantic and Pacific on the eastern boundary of California. Large land grants were reserved as a subsidy. The through route to the south was finally made by running down the San Joaquin Valley. This was pioneer work; the country was undeveloped. The foothills of the Sierras were full of mining camps, but nothing was present which could give a railroad a voluminous ton-



Map of San Joaquin Valley, Showing Southern Pacific Lines.

nage. As the mining days passed away, the population left the foothills and settled in the valley and along the line of railroad. The communities have in this way suited themselves to the transportation routes, and industries have grown up because of the facilities they have offered. Every part of the San Joaquin Valley can reach the railroad within half a day's journey by wagon. The railroad facilities of these valleys have also been ahead of the need, and the company has done pioneer work from the beginning. It has effectively met the demand for transportation and anticipated the lines of development. Thus the Southern Pacific Railroad Company, being first in the field, and building in a new country whose natural transportation routes were well defined, has always been able to supply all needed facilities. It possessed control of the strategic lines (see map). The only through route to the eastern markets was over its line. The short local roads already in existence as independent properties became mere feeders of this main system. With the fading of the days of high profits in California, the little roads were compelled to amalgamate with the trunk road. The Southern Pacific Company is to-day operating close upon 40 railroads, which were originally different enterprises, and "the one railroad" of California has been forced to become a unit by the demand for cheaper transportation. The constant diminution of rates made it absolutely necessary to seek the economies possible by a concentrated and unified administration. If a proportional volume of traffic had been induced by this lowering of rates, it is possible that some of the roads would still be operated as independent properties. There has been no room, up to the present, for another railroad in the territory drained by the Southern Pacific system. Had there been so it is probable that several of the larger projects among the 300 schemes which have been incorporated in the State would have been carried out, despite the fact that railroad capital has been kept out of the country by the hostile attitude of the people and the legislature to the existing company. It may occur to some that the railroads running into these separate valleys might well be under different control, and benefit the state by a competition in bringing to a common market the products of their respective regions. But the industrial conditions preclude this. The price of the products which these valleys have in common is not determined by the local market into which the roads enter, but by a foreign market; and since the bulk of the produce of each valley is different in character, any competition due to a common market is rendered inoperative.

While the hostility towards the Southern Pacific Company has been fostered by a demagogic legislature, there was unquestionably good cause for it twenty years ago. The railroad to-day is suffering for the sins of its fathers. Thus, when the road was being located through the San Joaquin Valley, it was usual for the communities through which it passed to give right of way and station grounds to assist its construction. In several notable instances, it is believed by the residents that sufficient inducement was not given to the railroad to pass through a town. Thus the town of Visalia was left 12 miles on one side, and the town of Tulare built up on railroad property. The most provoking case, however, is that of Bakersfield, the seat of the present discontent and the objective point of the new railroad scheme. Bakersfield is the county seat, and was so at the time the railroad went through. The town was passed by a quarter of a mile on one side and a station made one mile further on at Sumner. The site of the present town built around this station was railroad property and has consequently increased greatly in value. From the standpoint of immediate private profit, the railroad may have been justified in doing this, since it would obtain the traffic of Bakersfield under any circumstances and would enhance the value of its own property by locating the station where it did. Viewed in the light of the present, however, it was short-sighted policy, dictated by the speculative nature of the railroad building in California at that time, to destroy station facilities to Bakersfield. In justice, it must be said, that the site of Bakersfield is 20 feet lower than the Sumner level, as shown by the contours of the official map of the county; it also borders on swamp lands, and is subject to flood, being six feet below the highest known watermark. Sumner is the end of a division with costly fixed equipment; from an engineering standpoint, it would have been an error of judgment to put the division officers and fixtures at a place subject to flood. This does not justify the present lack of station facilities on the line at the point nearest Bakersfield. The hostile feeling of Bakersfield has also been nurtured by the seeming neglect with which it is treated. It is unfortunately situated, being about midway between the terminal points of San Francisco and Los Angeles, 482 miles apart. The place is served by a through train service, and, since the schedule is arranged with reference to these terminal points, it happens that the two trains bound for San Francisco leave at 11.20 p. m. and at 5.15 a. m., and those bound for Los Angeles leave at 10.05 p. m. and at 4.20 a. m. Such a service as this would exasperate any community, but the traffic does not justify the running of any local trains, so the people have to put up with this night service. That the residents complain is not a matter of surprise. That they have been compelled to live under such conditions is a matter of regret to the railroad company. The fact, however, that 20 years ago the needs of these towns of Visalia and Bakersfield were neglected has rankled with the residents and produced

hostility from the inception of the road. That much of the present complaint is due to the errors of judgment on the part of the railroad company in the past is evidenced by the fact that many of the complaints are 15 or 20 years old, and are retold by every stump speaker on an election campaign as though of recent occurrence. Thus, when the writer, a few weeks back, made a tour over the

which bound them, if elected, to vote for railroad legislation proposed by the association. The following pledge was enacted in 1892 by the Traffic Association from 23 candidates for the Senate and from 101 candidates for the Assembly:

"To pass a bill immediately upon the convening of the legislature so amending the constitution as to abrogate

TABLE A.—TWENTY YEARS OF RATES AND TRAFFIC—SOUTHERN PACIFIC COMPANY AND PENNSYLVANIA RAILROAD COMPANY.

Year.	Pennsylvania Railroad Company.			Southern Pacific Company.		
	Miles operated.	Rate per ton mile.	Tons hauled one mile per mile of road.	Miles operated.	Rate per ton mile.	Tons hauled one mile per mile of road.
		Cents.			Cents.	
1874.....	1,593	1.290	1,198,619	1,216	2.74	239,582
1875.....	1,631	1.126	1,247,299	1,298	2.83	243,909
1876.....	1,690	.951	1,314,638	1,425	2.73	255,069
1877.....	1,782	1.014	1,170,964	1,783	2.61	203,894
1878.....	1,782	.827	1,339,029	2,119	2.75	185,126
1879.....	1,872	.824	1,589,166	2,319	2.78	215,429
1880.....	1,876	.918	1,726,893	2,467	2.34	229,049
1881.....	1,856	.857	1,886,763	2,707	2.14	270,885
1882.....	2,017	.874	1,911,013	3,041	1.81	296,326
1883.....	2,102	.881	1,931,479	2,993	1.92	23,931
1884.....	2,268	.804	1,822,600	2,957	1.96	224,724
1885.....	2,316	.695	1,919,892	2,802	1.83	233,478
1886.....	2,387	.755	1,930,852	2,859	1.78	335,664
1887.....	2,412	.730	2,162,055	3,526	1.49	308,569
1888.....	2,436	.693	2,579,645	4,071	1.64	317,459
1889.....	2,456	.686	2,512,424	4,278	1.77	261,145
1890.....	2,501	.655	2,795,811	4,311	1.67	292,399
1891.....	2,573	.659	2,752,313	4,625	1.65	295,235
1892.....	2,658	.626	2,853,269	4,736	1.62	277,244
1893.....	2,724	.614	2,726,428	4,833	1.43	300,908
1894.....	4,870	1.215	314,673

roads in the disaffected part of the country, he heard retold on several separate occasions the same instances of injustice practiced by the railroad company that were published by the first "Board of Transportation Commissioners" in 1877.

It is foolhardy for anyone not thoroughly conversant with the whole mass of Pacific Railroad legislation to touch upon the land-grant question. There can be no doubt, however, that much of the present antipathy shown towards the company is the direct outcome of the unfortunate land troubles of from 12 to 15 years ago. As at the opening for settlement to-day of Government reservations there is a host of land-seekers, so, when the railroad received its grants, there were many settlers who

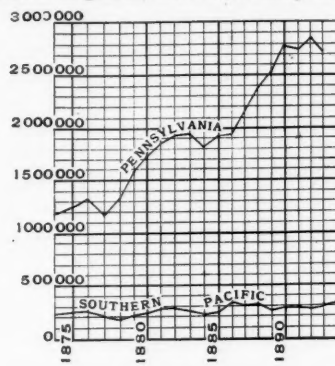


Fig. 1.
Fluctuations in Tonnage.
(Tons one mile per mile of road.)

were importunate and who wanted to settle on the railroad lands before the company was ready to place them on the market. A few years afterward, when the settlers had improved the land, the railroad appraised the holdings at their current value. The settlers demanded that their land should be appraised at its value when they first settled on it. This was impossible. Much litigation ensued and the settlers were finally ejected with bloodshed by United States marshals. These people are still living and cherish their grievances. Unfortunate mistakes have also been made by the United States Land Department in taking the money of settlers and giving them title to land which belonged to the railroad company. These settlers have been compelled to give up their lands, and no redress has been afforded by the Government. These errors have all reflected upon the management of the railroad, and it has been compelled to bear all the animosity thus engendered.

"We are under the thumb of the railroads, they have dominated our politics and controlled our legislature," is another complaint against "the one railroad" in California. From a study of the facts, it is improbable that the railroad has attempted to control legislation otherwise than in self-preservation. Its entrance into politics has been involuntary. From the time of the adoption of the new constitution in 1877, which provided for a board of Railroad Commissioners with absolute judicial and executive power over railroad interests in the state, the companies have been compelled to fight hostile legislation. Their influence has been a negative one. They have combatted legislation which would have destroyed them. Their policy appears at present to be an educational one, which attempts at every opportunity to lay bare the intricate problems connected with the railroad situation; when cases of injustice have been reported by the commission, the company has either removed the cause or presented careful arguments in defence of the position it maintained.

Much of the recent hostile railroad legislation has been prompted by the Traffic Association of California. It has obtained pledges from candidates for the legislature

that portion which provides for the regulation of rates and fares, and the provision for the State Board of Railroad Commissioners, and at the same time place the regulation of transportation companies in the hands of the legislature, removing any and all judicial features which may in any way interfere with such regulations."

The same legislature which gave this pledge to eliminate elements of judicial nature from the making of rates, passed at its last session "a bill to compel ladies to remove their bonnets in places of amusement." It has always been to legislatures of this type that the interests of the railroad corporations of the state have been confided.

This pledge produced in 1893 a bill which proposed that the constitution be amended and the clause providing for a board of railroad commissioners be abrogated, and that a permanent "distance tariff," adopted by the legislature and incorporated in the constitution, should fix all rates for transportation. All the railroad officials of any prominence in the state appeared before the Senate Committee and presented elaborate arguments against a measure which threatened the very existence of the roads, and defeated it. The proposed legislation was aimed at the Southern Pacific Company, since only those roads having a certain volume of gross earnings per mile were amenable to the proposed distance tariff. Little wonder, then, that it has been compelled to take up its own defense, and little wonder also that outside railroad capital will not enter California.

The rates charged by the Southern Pacific Company are said to be extortionate. Very little complaint is made of the passenger service; the whole crusade is against the freight rates. At the election last year two of the three candidates for the Board of Railroad Commissioners who were upheld by the Traffic Association were successful, and are pledged to a 25 per cent. reduction in the freight rates of the Southern Pacific Company, as a legislative and not as a judicial measure. An examination of the existing rates and of their tendency, as shown by the changes of the last decade, may help to decide the justice of this crusade.

Any comparison of California local rates with the local rates on Eastern roads must be inexact and misleading.

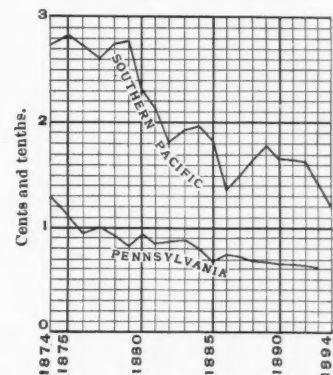


Fig. 2.
Fluctuations in Freight Rates.

The conditions in California are exceptional. Rates can only be compared on roads similarly situated and having similar traffic densities. Every circumstance affecting California's rate is peculiar to the state; no other state is bounded by so unproductive a country. The Sierra Nevada and the states of smallest commercial importance in the Union form its eastern boundary. On the north it is separated from Oregon by the meeting of the ranges which form the Sacramento Valley. Along the Coast line, rates are controlled by water competition, and much of the interior traffic gets the benefit of water com-

munication afforded by the arms of San Francisco Bay and the navigable waters of the San Joaquin and Sacramento Rivers. Over 75 per cent. of the traffic is affected by water communication. Not only do these conditions make any comparison of her rates with those of any of the other states impossible, but the long stretches of road passing across deserts and over mountains, and which bridge the unproductive territory between California and the Eastern markets, make the transportation conditions very unfavorable for economic operation. Along 25 per cent. of the lines of the Southern Pacific Company no local traffic arises. Five hundred miles of mountain track, having an average grade of 60 ft. per mile, makes the situation an incomparable one in the whole country. Table A, of the rate and traffic history of the Pennsylvania Railroad Company and the Southern Pacific Company explains itself to all who appreciate the influence of volume of tonnage upon the ability to make low rates. One consideration must not be lost sight of in a study of this table. The Southern Pacific Company has been doing pioneer work, and has tripled its mileage in 20 years, much of which has been built in unproductive territory. In the same time the Pennsylvania has doubled its mileage and has increased its tonnage nearly 250 per cent., while the increase of traffic density per mile on the California road has been a fraction over 50 per cent.

A graphic representation of rates and their fluctuations from year to year upon these two roads is given in Fig. 2, which shows the years plotted as abscissas, and the rates in cents as ordinates. Fig. 1 is a similar diagram, showing the changes in tonnage, from columns 4 and 7 of Table A, for succeeding years, the vertical columns representing.

[TO BE CONTINUED.]

Hollerith's Electric Tabulating Machine.

A number of prominent railroad accounting officers have recently examined, with much interest, an invention for doing the great mass of the figuring in a freight auditor's office by machinery, at a considerable saving in time and expense, and with perfect accuracy; and as the devices are exceedingly ingenious, and of interest to all

Fig. 4.—Sample of Punched Card, About One-fourth Size.

accounting officers, whether they are likely to use them or not, we shall try in this article to describe them, though it will not be possible, in the space available, to do so in full detail. The simplest form of Hollerith's machine is that which was used in the compilation of the last United States census, for assorting and adding units only. The principles of the device for doing this will be understood from the following brief description after which the application of the apparatus to the more complicated work of making up freight statistics, will be more readily understood.

In the last census a card was punched for each one of the sixty million units or persons enumerated. The cards described the characteristics of the respective persons by the location of the holes. In this way there was a record of the sex, age, race, conjugal condition, birthplace, occupation, etc., of each person. For counting the

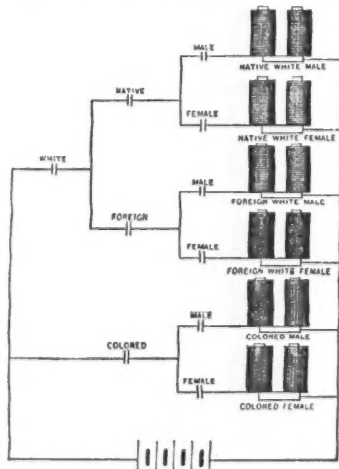


Fig. 5.—Electric Connections for Combination Counting.

simple elements these cards were passed through the electric tabulating machinery in which the punched holes controlled the circuits through electro-magnets of suitable counters. To illustrate the method of connecting a machine for counting combinations of various facts reference is had to Fig. 5. In the present instance it is arranged to count combinations of race, sex and general nativity. Relays are operated directly by means of the punched cards. These relays close secondary circuits, as shown in the diagram. For example, in the

present instance the current comes from the battery to one side of two relays. One of these relays is controlled by the holes punched in the cards corresponding to white, and the other to colored. According to which relay is closed the circuit continues, and in case of the whites is divided according to whether native or foreign, and finally according to whether the card represents a male or female. In this way an inspection of the diagram will show that only one counter magnet is operated according to the particular combination of race, sex and nativity punched in the given card. While this is one of the fundamental connections as used in the tabulations of a census, exactly the same principles would be applied in

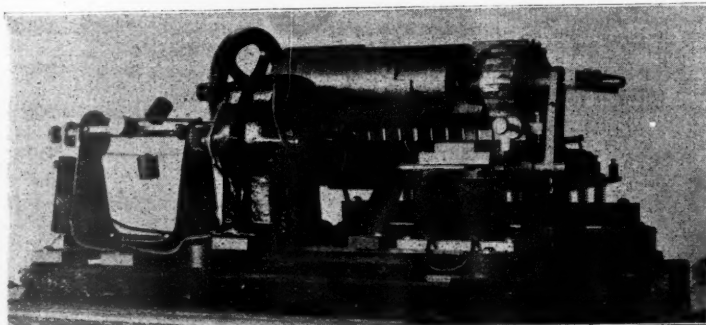


Fig. 6.—Integrating Machine.

tabulating cards representing freight movements. Thus, for example, the relays representing male and female might represent freight movements north or south, the weight being counted on one dial or another according to whether the given movement was north or south; or, a series of such relays may be used to designate the principal commodities. Passing the cards through the machine while counting the money items we can thus also directly ascertain from one operation the weight of each of the principal commodities forwarded or received at a given station.

The constant enlargement of railroad accounting offices throughout the country has led progressive auditors to the exercise of much ingenuity in devising methods to arrive at results with the greatest directness consistent with safety. But in all strictly manual methods there is a limit, which some believe has already been reached. The next step is the introduction of mechanical processes to supplant the slower and less accurate work of clerks. The great cost of handling figures does not lie so much in the direct work as in the "checking back," and dead work to locate errors in carrying first data to final results. There was needed some process by which the first data could be intercepted at an early stage and carried through to final results without use of paper and pencil. To be successful it must be radical and comprehensive.

Perhaps the largest single "figuring shop" known was the office of the last census. The simple work of handling figures here reached a magnitude that made the inadequacy and extravagance of manual processes clearly evident. Various ingenious devices for relief were under consideration until Mr. Herman Hollerith, who had been employed in the previous census, came forward with the proposition to handle the figures by electricity. The method was so radical that a special commission was appointed to investigate his methods. After an actual test they reported in favor of the Hollerith method on the basis of an estimated economy of \$523,000, and his devices were adopted. This estimate was exceeded in actual work, so far as punching the records was concerned, 40 per cent. The results attracted much attention abroad and the Austrian and Canadian censuses have since been handled in the same way.

Recently this method has been adapted to railroad accounting. All accounting in a last analysis is the ascertaining and sorting of first data and the aggregation of the sortings. The Hollerith method intercepts this first data at the earliest possible stage and transcribes it to punched cards which the machine will automatically read, sort, select and reject. From this stage up to the recording of the final results the work is mechanical. The method is not a single device, but a combination of simple parts based upon an elastic principle capable of great variety of adaptation.

The heaviest work of a railroad accounting office is in freight accounting and statistics, and it is here where relief would be most desirable, and a method of applying this apparatus to freight accounting is here given in outline. It is only a general plan, subject to various modifications according to the special conditions to be met.

The tissue copies of way-bills forwarded, which come daily to the central office, after they have been revised, are transcribed to punched cards by means of a keyboard punch, operated at a speed faster than such a record could be made by writing. This punch is illustrated by Fig. 1. It consists of a frame on which is mounted a card holder into which the cards can readily be inserted. Moving over this card is a punch, the motion of which is controlled by a suitable knob or handle passing over an enlarged keyplate. This keyplate is provided with holes suitably lettered and numbered, and so arranged that if the handle is depressed into one of these holes a corresponding hole is punched in the card. This, then, is simply an enlarged and improved mechanical device for punching records as is constantly done in the passenger department with an ordinary conductor's punch.

The tissues come into the office in the order of for-

warding stations and way-bill number, and no preliminary sorting is required. One card is punched for each way-bill, showing the destination, the direction in which the goods were forwarded, the commodity, weight, freight, advanced charges and prepaid, receiving and delivering roads, and any other desired information. After transcribing in this way the detailed information of each way-bill, which varies from one bill to another, the items common to a number of them, as month, day, year and forwarding station, are recorded by the gang punch, shown in Fig. 2.

The gang punch is provided with a number of interchangeable punches. These can be set to any desired combination. The punch is arranged so that five or six cards can be rapidly inserted in the punch, and by a single operation of a treadle, the combination of holes, giving the year, month, day, forwarding station, etc., is punched. With this machine as many as 40,000 cards have been thus punched in a single day.

The cards are now sorted to the received stations by means of the sorting machine shown in Fig. 3. This consists of a hard rubber bed plate provided with holes corresponding in number and relative position to the possible holes which can be punched in the card. Each one of the holes is partially filled with mercury and is connected by a wire to a suitable switchboard. Above the plate is a reciprocating pin-box provided with a number of projecting spring-actuated steel pins corresponding in number and position with the holes in the bed plate. Placing a punched card on the plate and depressing the lever we find that all the pins are pressed back except such as come over the punched holes. These pass through to the mercury below and in this way close electric circuits through electro-magnets, which control the operation of the sorting box lids. The card under the pin-box thus causes the opening of one of the sorting box lids according to the combination of holes punched in the card. Each card is thus rapidly placed in the press and then thrown into the sorting box, which is opened by it. This electric contact device or press is so arranged that if the card is accidentally placed so as to uncover holes which should be covered, the entire ma-

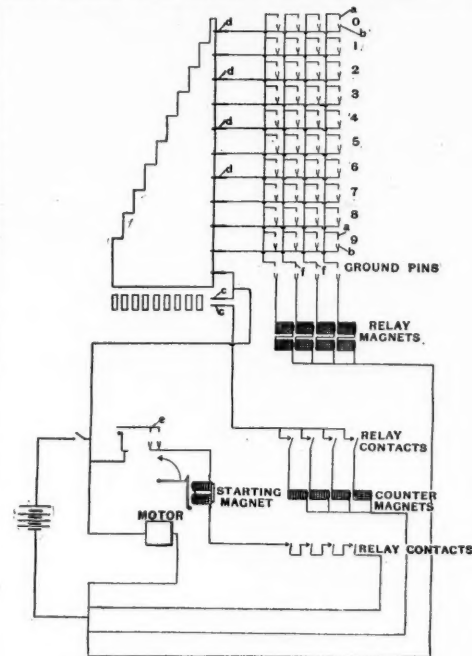


Fig. 7.—Electric Circuits of Integrating Machine.

chine refuses to operate, and in this way any erroneous sorting of the card is absolutely prevented. The rapidity with which such cards can be sorted depends, of course, on the expertness of the operator. As many as 20,000 cards have been sorted in a day of 6½ hours. There is no mental work whatever required. No error can be made, and therefore any quick active boy can be employed for such work with great advantage.

The cards thus sorted to receiving stations are placed in suitable pigeon holes. When the report of the receiving agent comes in it is taken to the corresponding pigeon hole and the cards there are checked off against the report. If the punched card agrees with the received report the entries on the receiving agent's books are correct and the transcript from the tissues to the punched card is correct. Such cards, if desired, can now be given a progressive number and gang punched with the day and month the way-bill or freight is received at the received station. In case there is a discrepancy in the amount of any way-bill between the card and the report the error is located and corrected. Cards not found on the receiving agent's reports represent goods still in transit. We now have on our cards, besides a transcript of the original way-bill, the date forwarded, the date received and the information that the receiving agent has

taken it up at the proper amount. They are in the order of receiving stations. In this order they are passed through the electric tabulating and adding machine.

This machine is arranged with a mercury-cup circuit-closing device like that in the sorting machine. In fact, the tabulating and sorting machines can be and often are combined in one apparatus. In the case of the tabulating machine, however, circuits are closed through an integrating drum (described below) to a series of counters, one for each column to be added. This integrating drum is so arranged that the electro-magnet of each counter receives from 0 to 9 electrical impulses for each card, according to the position or value of the given hole punched in the column corresponding to any given counter. In passing a number of cards through the

located and finally corrected. As these cards can easily be added at the rate of 1,000 to 1,500 an hour, it will readily be seen that the labor of adding is comparatively slight. After having thus verified the received reports the cards are sorted according to forwarding stations and treated in the same way, thus fully verifying the agents' reports.

In order to obtain the ton miles, let us assume first the simple case of a straight road, or a road without branches. As described above, we have obtained the weight forwarded north, for example, from each station. Multiply such weights by the distances of the stations from the end of the road, and add such products together. This would give us the ton miles moved north, on the supposition that all the freight went to the end of

moved north, and consisted of lumber. The weight was 45,900 lbs. The freight for this shipment was \$24.50, the advanced charges were \$13.75 and the prepaid was \$30. Of course, instead of using large letters to designate the divisions or sections of a road and small letters to designate the stations in these sections, numbers can be used quite as well. Again, in many waybills the items of charges and prepaid are blank, in which case the punching is facilitated by punching X's at the tops of the respective columns. Punching this one hole is equivalent to saying that the given columns are blank.

The appearance of the integrating machine is shown by fig. 6; and in fig. 7, the circuits of this machine are shown. The pins of the pin box are represented by *a*, and the mercury cups in the hard rubber plate below such pin

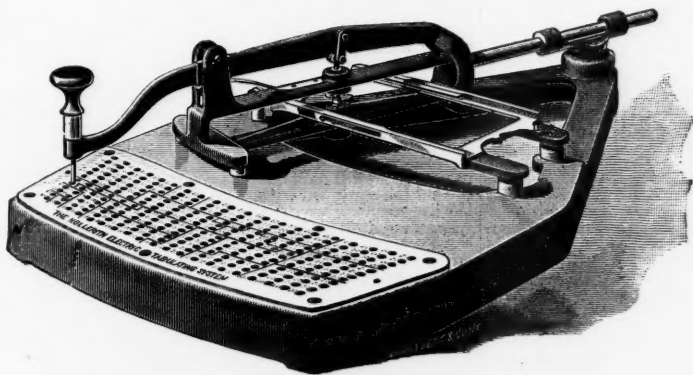


Fig. 1.—Keyboard Punch.



Fig. 3.—Sorting Machine.

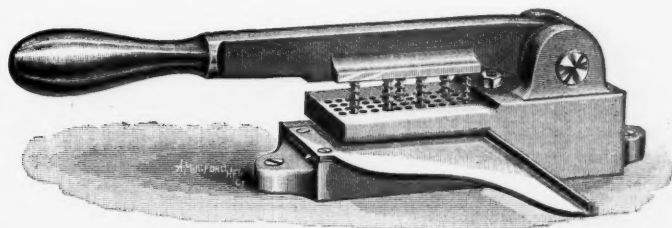


Fig. 2.—Gang Punch.

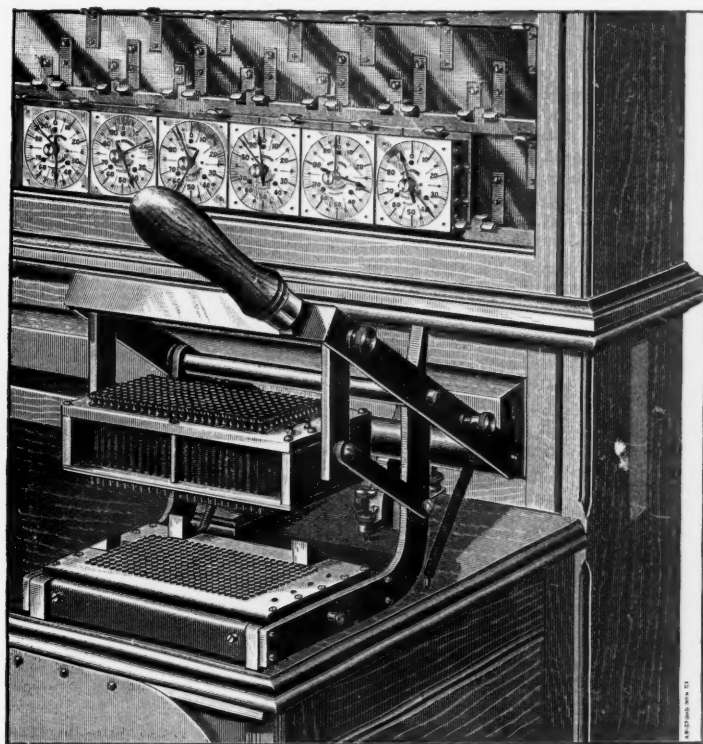


Fig. 8.—Circuit-Closing Press.

Hollerith's Electric Sorting and Tabulating Machine.

tabulating machine the electro-magnet of any given counter thus receives as many electrical impulses as the sum of the digits in that particular column. It must be remembered that this machine will thus tabulate or add any number of columns, simply being limited by the size of the card, and that this can be done at a speed of 1,000 to 1,500 cards per hour. This tabulating machine is also controlled so as not to count any card which is not properly placed in the press, and to reject any cards not properly punched. Of course the machine cannot discriminate an error such as seven instead of nine being punched in the card, but in case the operator has failed to complete the record, omitting to punch some items which should be punched, such cards would be absolutely rejected by this tabulating machine. It must also be noted that this machine will classify the addition that it makes. Thus it will add to one set of counters or another according as the card represents a freight movement north or south, and all this is done without any mental work or skill on the part of the operator. In a similar way, if desired, the weights of certain selected commodities could be added at the same time without retarding the operation of the machine.

On the dials in front of the operator (shown in Fig. 8) are thus recorded automatically the weight received north, weight received south, freight, advanced charges and prepaid, and from these the readings are taken for the total received at each station. In case of the larger stations, it may be desirable to take a reading at the end of certain periods during the month, or even at the end of cards representing each day, for the purpose of more readily locating any discrepancy which may arise. When all the cards have been passed through we have a total of freight, charges and prepaid, to compare with the agents reports. If they agree the cards are treated as will further be described. In case of discrepancy, by noting the readings at the end of certain periods, the portion of the report in which the discrepancy occurs can be

located and finally corrected. As these cards can easily be added at the rate of 1,000 to 1,500 an hour, it will readily be seen that the labor of adding is comparatively slight. After having thus verified the received reports the cards are sorted according to forwarding stations and treated in the same way, thus fully verifying the agents' reports.

In order to obtain the ton miles, let us assume first the simple case of a straight road, or a road without branches. As described above, we have obtained the weight forwarded north, for example, from each station. Multiply such weights by the distances of the stations from the end of the road, and add such products together. This would give us the ton miles moved north, on the supposition that all the freight went to the end of

After the cards have been thus used for checking the agents' accounts they furnish us with all the data necessary for statistics. By use of these machines, we can readily obtain from these cards not only the weight of each commodity forwarded from each station, but the revenue for transporting such commodity. We can by simply shifting the cards obtain the weight of each commodity received at each station. We can obtain the total ton miles north and ton miles south for each commodity, or, in other words, by simple treatment of the cards any possible combination of the data can be obtained.

The illustration, Fig. 4, shows a card representing a freight shipment from station Mr to station Bf. It

box by *b*. If a card is placed in the press and the handle brought down it will be noticed that a circuit is closed from each column through two relay magnets, this being effected by the ground pins, which are pins in the pin box falling outside of the edge of the card. The contacts of one set of relays are connected in series through a starting magnet. This starting magnet controls the revolution of the integrating drum. If the armature of the starting magnet is attracted the motor then revolves the integrating drum. Each counter magnet will receive from one to nine impulses through the brushes *c c*, according to the length of time that the relays are held closed, this being determined by the position of the hole in the given column, or, in other words, through which brush (*d*) the relay is closed.

The pins (*e*) are at one end of the card, and it will be noticed that unless these pins go into the mercury cups below, the starting magnet circuit cannot be closed. This prevents erroneous counting due to the card being shifted laterally. On the other hand, if one of the ground pins (*f*) should be kept back or the card were not properly placed against the registers, one or more of the relay contacts controlling the starting magnet would be open, and thus again prevent the erroneous counting due to the card not being properly registered in the press. In other words, the starting magnet is only operated when the card is properly placed in the machine. Again, should the punching of a hole in any one column be omitted through carelessness on the part of the clerk, the corresponding relay circuit again remains open, and thereby prevents the starting magnet operating, thus rejecting all such erroneously punched cards.

While the method of accounting, as described above, embraces first adding on the received side and then on the forwarded side, under certain conditions it may be desirable to keep apart certain important combinations

of stations. For example, between two given points there may be a large traffic, and to reduce the labor it might be desirable to treat these separately, as passing such cards through the machine once would, of course, give us all the data regarding that particular portion of the traffic. It is, of course, true that all the work might be done by station-to-station groups. The possible combinations of stations on an ordinary road, however, is so great that the cards would fall into such exceedingly small groups that the labor of writing the records becomes much greater than the labor of handling the cards several times over. This can readily be understood when it is remembered that a road of 100 stations would have 9,900 possible combinations of station groups, which would require, assuming that goods passed between every combination of stations, that many (9,900) entries; whereas, handling on the forwarded and then on the received side would simply require 200 entries; and remembering that cards can be added at the rate of from 1,000 to 1,500 an hour, it is apparent that the labor of the additional entries would be far greater than handling the cards twice.

We have only described the application of these punched record cards for the purpose of settling agents' accounts. The limits of this article will not permit us to show how these same cards can be mechanically handled to obtain statistics regarding the various commodities forwarded from the different stations or received at the different stations, or the ton miles for freight received from various connecting lines, or of freight delivered to the connecting lines, the interchange between divisions of the road, the settlement of solid billing accounts, the relative earnings on competitive and non-competitive freight, and various other accounting and statistical data which can be obtained from these same cards by various modifications of the methods above described. Incidentally, too, it may be noted that much information which would not be valuable, based on observations of the business of a given month, might be valuable if based on the business of a year. Such punched cards can readily be stored and are ready for mechanical treatment at any time. In fact, these cards will at any time answer any questions which can be put to them, based upon the various items recorded.

The Air Brakemen's Convention.

We give below abstracts of the reports of some of the committees presented at the recent meeting in St. Louis of the Air Brakemen's Association:

ON HOLDING TRAINS ON MOUNTAIN GRADES.

Long and practical experience has proved that holding trains on mountain grades is a branch of the service that requires the utmost vigilance and care, and new employees should be thoroughly examined as to their competency.

The engineer should know the number and condition of the brakes in his train before leaving the summit; be aware that all brakes do not recharge in equal lengths of time, so as to make liberal allowances for such variations, and avoid a strong application at the beginning of a descent, thereby quickly slowing his train down and necessitating a release which occasions a loss of air.

Too short a piston travel is to be avoided, as a slight reduction beyond what is actually necessary to control the train, would materially increase the power and retard the speed so much as to necessitate an early release, thus wasting more air than would be saved by reduced volume. A travel of from 6 to 8 in. is recommended. The size of the main reservoir is important, and a capacity from 25,000 to 30,000 cu. in. is desirable.

The use of the driver brake is of the utmost importance, and the cutting out of it is condemned. The Le Chatelier brake as an auxiliary is recommended. When this is used the driver brake may be cut out by a cock in the pipe between the triple and brake-cylinder.

On starting the train from the summit, after having put the brakes in as good a condition as time will permit, an application should be made before full speed is attained, so as to determine the efficiency of the brakes, noting at the time the number of pounds reduction necessary to hold the train. If there are no leakages it may be regarded as safe to prolong the time between applications, but the loss of air must never be overlooked and every chance be taken to recharge. The use of pressure retaining valves on both cars and tenders is strongly recommended. The practice of cutting out part of the air-brakes in a train should never be followed.

SLID FLAT WHEELS.

It does not seem possible that sliding can be entirely prevented where the proper amount of braking power is available, for this amount should never be reduced below that which will stop the train in the shortest possible distance in an emergency, and this will under adverse conditions, result in sliding the wheels enough to cause flattening.

It is now generally conceded that the best braking force for passenger cars is 90 per cent., and for freight cars is 70 per cent., and until all conditions are brought up to a certain standard it is not considered advisable to raise this percentage in freight cars. While it may be necessary to exceed this standard percentage in cars operated on heavy grades, this excess should be secured by increased pressure in the brake-cylinders, and not by change in the leverage.

The causes for wheel sliding may be classed as follows: Excessive brake power; adverse conditions and maximum brake power; unequal distribution of retarding force; and miscellaneous causes.

By excessive brake power is meant a force of over 70 per cent. for freight cars, 75 per cent. for engine trucks and driver brakes, and 90 per cent. for passenger cars. The means by which the brake power may exceed the maximum allowed are carelessness in equipping and repairing, improper designs, failure of brake rigging to equalize, sloping tenders and cars with different weights on trucks, crooked levers, shrinkage in weight of car, use of hand-brakes in conjunction with the air, use of flanged shoes, too high air pressure, auxiliary reservoirs too large for cylinders, and too short piston travel for per cent. braked.

By adverse conditions are meant bad rails, due to

frost, moisture, etc.; frogs, crossings, rough track and mislaid wheels; low speed and use of the emergency, and only a part of the cars in a train being equipped with air.

Some of the causes for unequal distribution of the retaining force arise from unbraked wheels; auxiliary reservoir not properly proportioned for cylinder; leakage, unequal piston travel, improper use of retaining valves, incorrect angle of brakebeam hangers and of levers with pull rods, brakebeam springs, variation in shoe friction, plain and quick action triples in the same train, new brake shoes, and chilled cast wheels with tread as it comes from the mold, and independent driver brakes.

To decrease this sliding and at the same time to increase the efficiency of the brake, the following recommendations are offered, that as far as possible brakes be applied to all wheels, operated continuously and all kept cut in: quick action triples be used except on engines and tenders, that being thus equipped passenger coaches and tenders be braked at 90 per cent., and freight cars at 70 per cent. of light weight, this to be figured from a cylinder pressure of 60 lbs. per square inch for passenger and freight cars and 50 lbs. for tenders; a uniformly strong brake rigging be employed, pressure retaining valves be used on tenders; that selection of shoes with reference to tires be such as will give uniform amount of retardation; where flanged shoes are used on passenger cars that the braking power be reduced from 90 to 80 per cent., and that such shoes be applied to steel tired wheels only, that all leakage be avoided, that piston travel on passenger cars be 6 in. and on freight not less than 5 or more than 8 in., that a brake shoe with ample rubbing surface be provided, that in freight service a variation in wheel diameter of not more than $\frac{1}{8}$ in. be allowed, that cylinder levers for passenger cars have inner end so constructed that it is impossible for it to enter piston rod crosshead, the use of large main reservoir capacity and low excess pressure, that 12 x 33 in. auxiliary reservoirs for 8 in. tender brake cylinders be changed to 10 x 24 in.; the elimination of brakebeam springs; that engineers be taught the correct way of applying brakes, that the use of conductors valve and rear cock of train be avoided except in cases of necessity, the employment of a thorough system of inspection using regular blanks to report defects.

FOUNDATION BRAKES.

Perhaps there has been nothing pertaining to air-brakes that has been so much neglected as the foundation brake gear. It is the intention in this paper to suggest what constitutes an efficient brake gear capable of standing its work for a long time at a minimum cost of maintenance.

The standards of the Master Car Builder's Association are considered fully equal to the work and a lighter gear is subject to more or less distortion under the strain which has a marked effect on increasing the piston travel and reducing the braking power. In adjusting the piston travel, lower pressures are more frequently employed than in actual practice which may result in the piston travel in service being more than is intended, this increased deflection of the beams and levers, reducing the braking power and incurring the danger of the piston striking the head of the cylinder. With a heavy unyielding gear there is no danger of this and the piston travel is easily determined.

Metallic brakebeams are preferred hung so that their centers should not be over two inches below the center of the wheels, with the angle of the hangers such that their center lines intersect at right angles a radial line from the wheel center to the center of the beam, when the thickness of the shoes or ties is intermediate between new and worn out. The shape of the hanger has no consideration. So far as the braking power is concerned, there is no apparent difference between inside and outside hung brakes for freight cars, though with truck frames so constructed that there is ample space for hanging inside beams well up to the center of the wheel, the suspension being from the bolster, the inside-hung brakes would be preferable, doing away, as they would, with top rods, passing over the bolster, making a more convenient arrangement of levers, and causing the beams to maintain their relative position to the wheels when on a curve.

The brake-heads should be of such contours that the beams will be in a horizontal plane when the shoes are pressed against the wheels. The main feature to be observed is in the employment of such a form that worn-out shoes may be replaced at a minimum cost.

Four and one-half to one live and dead levers are believed to be the best proportion for passenger equipment. With a less proportion the loss must be compensated for with the cylinder lever, in which it is not considered good practice to have a very short end of the lever next to the cylinder. The use of more than one hole in the outer end of the cylinder lever is not to be recommended, owing to the danger of connecting the top rod to the wrong hole. It is also considered preferable to classify cars by weight, and have a standard lever for each class. These levers should always be of a standard length, thus permitting the cylinders to be located at a uniform distance from the center of the car, and the necessary variation in leverage secured by the location of the tie-rod holes. All holes should be drilled, and turned pins are recommended, as are also two holes in the jaw of the upper pull-rod and two in dead-lever jaw of the bottom-rod that a better angularity of lever may be obtained, and additional opportunity to adjust the piston travel. Live levers should stand at right angles to pull-rods for 7 ins. of piston travel.

In locating the cylinder care should be taken that the cylinder head and triple may be easily removed and free access given to the oil hole plug in the cylinder.

The Hodge system is recommended as best passenger equipment, though the Stevens is somewhat simpler, the former admitting of a better hand brake gear.

The idea of a uniform system of levers for all cars, regardless of weight, with the braking force regulated by different sizes of cylinders is condemned.

The present arrangement of the hand brake connection is not what it should be, as a comparatively low brakein? power is exerted at best. By lengthening the jaw of the push rod and inserting a sheave in it with a chain passing round the sheave and fastened at one end to the car frame, about double the power could be obtained. The arrangement of the hand brakes should be such that they can be operated by the trainmen in conjunction with the air without danger.

The foundation gear recommended for a tender is of the freight-car pattern, with the exception that the floating cylinder lever should be of the same length as the cylinder lever which should be attached to a jaw fastened to the front cylinder head, instead of to the car body. One hundred per cent. of light weight is considered as safe braking power for tender.

DRIVER AND ENGINE TRUCK BRAKES.

The practicability of driver brakes is beyond question, and, besides being a valuable adjunct to the train brake,

it is a direct benefit as a tire dresser and has been made imperative by legislation. That it is possible for it to exert detrimental strains when the wedges are down or if there is excessive lost motion in driving box brasses, and a cam brake is employed, is unquestionable; yet even without a brake such a state of affairs is injurious to the engine. It only remains to select the best style of brake and to ascertain the most economical methods of maintaining them at their highest state of efficiency.

That engine truck brakes interfere with the adjustment of the truck in curves is also erroneous, and such brakes are all contained within the truck; and while the need is not so imperative as for driver brakes, yet the results of tests with these brakes, both in use and out, show a gain in the distance required for a stop. Its use also reduces materially the maximum braking power necessary on the cars.

For locomotives with six or more wheels connected, there is practically but one style of driver brake, viz.: the outside equalized, and for four-wheeled connected engines, two more in addition to this: the spread wheels acting between the wheels, and the clasp or squeeze brake acting on both sides of the wheels. Of these three designs, the outside equalized brake where the brake power acts, towards the rear of the engine, and by a system of levers is distributed equally on the wheels, is preferred.

The use of continuous instead of independent driver brakes is advocated, and to avoid danger of overheating the tires by a continuous application of the brakes while descending a grade, a cut-out cock can be placed in the pipe leading from the triple to brake cylinder with its handle arranged so it can be operated from the cab, and the engine equipped with the Chatelier brake for use in such cases.

Brake cylinders should be of sufficient size to prevent the necessity of employing excessively high leverage, one of the push type wherever practicable, and protected as much as possible from the heat of the firebox. Leather packing is considered best. For 8-in. cylinders supplied by a 10 x 24-in. reservoir, a minimum piston travel of 2 in. is recommended, for 10 and 12-in. cylinders with 12 x 33-in. reservoir, $2\frac{1}{2}$ in. travel; for 12 and 14-in. cylinders with 16 x 33-in. cylinders, 4 in. travel.

Retaining valves on tenders are advisable and should be located where they can be readily operated by engineer or fireman while train is running.

The Card Index.

BY J. A. ANDERSON.

Probably most business concerns having large records to keep are fully aware of the value for such purpose of the card index or catalogue, so long used by our large libraries; but whether the use of this instrument is as extensive as its value deserves may be questioned. The writer in 1886 found its use quite limited, in the class of establishments respecting which he made inquiry and in which it would have been found especially valuable.

In organizing an institution involving extensive lists of names with records of many minute facts relating to each, the plan was adopted of assigning a number to each name and recording these in consecutive order. The papers and records relating to each were then marked with the proper number and put away in such manner as to be readily referred to when a given number was wanted. This method admitted of stowing without loss of space. A card index was then made, each card containing the name of the person whose number appeared on it, the cards being placed in drawers alphabetically in the usual way. This index now represents about 65,000 names, any one of which with all records relating to it, whether in book or filed papers, may be found with the same facility as a book in a library.

Certain frequently recurring circumstances relating to the persons so recorded were at first entered consecutively in volumes devoted to the purpose; but it was frequently necessary to collect these facts for individual cases, and as time went on the labor and time consumed in this became enormous, and a separate index was made for this purpose, in which each card contains a man's name and number and on it are recorded the incidents referred to as they occur. Thus, all for an individual are together, and a simple reference to the catalogue gives the whole record. The volumes for this particular record were of no further use and were abandoned. The expense of preparing this second catalogue was great, as it had to contain all the past records, but it paid for itself many times over. As an instance, it may be stated that a particular search that under the former plan would occupy a day may now be completed in an hour.

The number of deceased persons in the list became such that it was desirable to remove their papers to a separate place to avoid the necessity of handling them in making searches as well as to make more room for additions. The papers thus removed were at first so placed that the numbers ran consecutively, with spaces allowed, as judgment might indicate, for additions. This was found to require a good deal of space and the plan has been recently adopted of giving these papers a separate series of numbers, arranging them consecutively, with a subsidiary card catalogue.

The great value of this plan of cataloguing is illustrated in the experience of the son of the writer, who is engaged in the practice of law and has a large number of papers requiring constant reference. These are numbered and arranged numerically as they accumulate, with a card catalogue. Reference to any one is easy, with an immense saving of time and labor as compared with depending on the memory and insufficient arrangements for filing. Besides records of cases, this list affords easy means of noting decisions or important matters met with in reading, and of classifying them so that they may be referred to with the least possible labor.

If any reader of the *Railroad Gazette* shall be led by the above description to make use of this method of reference, he will, without doubt, be glad that his attention has been called to it.

The Status of the Gas Engine.

At the last "Engineering Evening" of the American Society of Mechanical Engineers, held April 10th, the subject of "The Status of the Gas Engine" was introduced by Mr. Reeve and was discussed by a number of the members present. Mr. Emerson McMillan was chairman for the evening. In introducing Mr. Reeve he spoke of the gas engine as a piece of mechanism hitherto greatly underrated and kept from general use by heavy royalties to the German inventors, high prices to the manufacturers, the indifference of gas engineers and the parsimony of gas companies.

Mr. Reeve said: "The status of the gas engine, like that of anything else, depends upon the surrounding conditions. Its status to-day is what it has been forced to be and allowed to be by the general commercial and engineering conditions of the world. It is the status of the power question of the world, and its importance depends as much upon the conditions of other forms of power as upon the condition of the gas engine itself.

The gas engine comes into competition with those forms of power applicable to almost any locality or set of conditions. Steam power is almost the only other occupant of that class of prime movers. The condition of steam power has varied considerably during the past few years. Practically the factory and the steam engine grew up together, and while the plan of a large central motor driving tools through lines of shafting, belts, etc., still survives in certain lines of industry, and will continue to survive in the future on a still more important scale, yet for the vast majority of industries, especially those involving a varied number of processes and the production of comparatively complex commodities, the modern factory is a collection of factories, in which power must be subdivided. Whether, as in some cases, labor is a small item and power a large one, or vice versa, the various conditions make it almost impossible for such an establishment to be driven by one central prime mover. The two great objections are losses in transmission from a distance and losses from working under varying conditions. We have therefore seen grow up in the past few years the modern industrial works in which the power must be transmitted some distance and subdivided among a large number of different kinds of tools. After attempting this transmission by shafting and belting, rope drives, etc., the central engine was divided into a large number of units to avoid these transmission losses. In many cases steam is furnished from a central plant to anywhere from 10 to 70 different engines all over the works. Sometimes the losses in steam transmission are less than for shafting and belting, though no rule can be given for these conditions. In later years, superseding the subdivided steam plant to some extent, came first, compressed air, and second, electric transmission and subdivision of power.

The problem of the present is economical transmission, not economical development of power, although the latter is, of course, of great importance; since the losses in transmission can easily exceed the largest possible losses in production. None of the systems heretofore provided satisfy the question, since they all involve enormous losses in transmission, heavy first cost, and expenditure for generating plant, transmission plant and re-developing plant at the other end. Using electrical transmission, a 1,000 H. P. boiler plant, steam engine, generator and motors are all necessary in the factory requiring this amount of power. This is, of course, exclusive of small factors and percentages of loss.

The present status of gas power in this or any other country, and its immediate promise for the future depend upon this statement of the problem, that "Gas power offers the ideal solution for the subdivision and transmission of power, the mechanical difficulties being for the time lost sight of." In a factory requiring 1,000 H. P., if we install a 1,000 H. P. gas generator or its equivalent, and then conduct the gas to a large number of gas engines, it is evident that the first cost is below that of any system, with the possible exception of the subdivided steam plant. In point of operation, in the case of steam, the central generating plant must be run no matter how large a proportion of the load be off, and the fixed charges of running cannot be altered. Steam must be kept up, the boilers and stack must be kept hot and the labor must be there in any case. I have tested one factory, in which, for a large proportion of the day, the efficiency for the transmission of the power between the boiler plant and the work was 5 per cent. simply because they had to keep the whole plant going in order to move one small department. With the gas plant this is not the case, since the gas generator works only for a certain number of hours a day to whatever capacity is best suited to produce maximum economy. The gas thus made is stored in the holder and the engines in the various departments may run 24 hours in a day, while the gas generator runs only 8 hours, provided the total maximum production of the gas generator is large enough to cover the whole output of power. From this point of view comparison between the gas power plant and any other is almost impossible, the gas plant being so much more economical.

You will notice that I have purposely left out of the question the mechanical side of it. For the merely commercial side there is an absolutely unlimited field for the development of power and its transmission and subdivision by means of the gas generator and engine.

Another large argument in favor of a plant of this sort is that the supply of power can be made to correlate with the other portions of the work. As steam power is the

proper motive power where much steam is used for heating, boiling, dyeing and other purposes, and as compressed air is the proper form where compressed air is indispensable for blowing and numerous other purposes throughout the plant, so in such works as glass works, metallurgical works, etc., where gas can be used for many kinds of cooking and heating, baking, etc., where exact temperatures and exact control of temperatures must be had, a gas engine would certainly have no competitors.

The reply to this side of the discussion is that the mechanical difficulties have not yet been overcome and that the gas engine is still more crude in mechanical features than was the steam engine of a century ago. In nearly all of the devices, only one impulse is received by the fly wheels for every two revolutions; in the case of single-acting engines only one is received. This makes the fly wheels very heavy. The regulation is generally accomplished by simply dropping out a certain proportion of the impulses instead of varying their strength, and the necessity for the ignition of the charge in a minute fraction of a second has led, until very recently, to great uncertainty in the matter of ignition and perfection of combustion. The mechanical difficulties still stand in the way of the accession of the gas engine to its proper field; that is, the universal factor for the production, transmission and subdivision of power in industrial works.

While gas engines have hitherto been almost entirely run with illuminating gas, considerable work has been done in supplying them with special producer gas. I may also mention the incandescent gas burner that has just begun to attract such wide attention. Coupling together the facts that the gas engine can be run much more economically with producer gas than with illuminating gas, and that a means has been attained of producing illumination with a non-luminous gas, leads us to perhaps surmise that the near future will see the distribution of all energy which is derived from coal in the form of a non-luminous, cheaply produced fuel gas, relied on entirely for power, for gas lighting where such is permissible, and for electric lighting through the medium of gas engines where electric lighting is needed. Further, the same gas will be used for all sorts of fuel and heating purposes.

I have tried to make as brief a statement as I could of the gas engine problem, as it appears to me to-day; not on the basis of the condition of the engine itself, but as a statement of its possibilities and of what the near future may bring forth in the way of a powerful auxiliary to and in the adoption of the gas engine as a universal prime mover.

Mr. Burchard then read a paper upon the subject, which we are unable at this time to reproduce.

A discussion was then read by Professor Hutton, communicated by Professor William S. Aldrich, of West Virginia University. We make some extracts from it:

The improvements in the manufacture of producer gas on a small yet economical scale have removed some of the chief difficulties in the way of the introduction of gas engines. The distribution of power from a central gas plant offers peculiar advantages, since there are practically no losses in distribution. Losses of pressure and temperature changes do not in any way affect the economy of the gas engine at the end of the line.

The use of gas engines of 300 H. P. and the contemplated building of much larger ones leave no room for doubting that these engines can be economically made in large units, but it is a question whether there is the same gain in economy in the use of large gas engines as in the use of large steam engines.

Concerning the arrangement of the gas engine cylinders the vertical types are preferred, in pairs with cranks at 180 degrees apart. Quadruplex gas engines are being considered, to gain the advantages of a greater number of explosions per revolution, and consequently increased opportunity to control the supply and the explosions according to the load. Rotary gas engines have been suggested, utilizing the explosions of the gas very much in the way the Pelton water wheel utilizes the impact of water. This eliminates losses due to connecting rod mechanism, and very high speeds may be obtained. Multiple-discharged jets may be arranged as in the Pelton wheel, utilizing the force of the explosion tangentially, while internal friction becomes a minimum. Further, the best opportunities are presented for regulating against rapidly varying loads and a greater economy in use of gas would probably result.

The regulation of speed in gas engines presents very great difficulties. During one or more strokes the supply of gas may be omitted entirely when running at low speeds with varying loads and the unusually heavy fly wheel must be drawn upon to meet variations in the supply of energy.

It is possible to establish a satisfactory basis for rating gas engines by their most economical performance; that is, the maximum economy under a certain best load for a given engine at a given speed. If gas engines were tested and the curves of performance plotted as in the case of turbines sent to the Holyoke testing flume, the whole gas engine problem would be placed on as satisfactory and substantial a basis as is the case with turbines. The establishment of such a gas engine testing plant is urgently needed and would go far toward giving additional encouragement to the development of the gas engine.

Dr. C. E. Emery asked for information concerning the construction of the Dausen producer used extensively abroad. In reply Mr. McMillan said that it is not what would be called a water gas producer, being more nearly

like those used in metallurgical processes. It does not make a gas of so high power as water gas, while it contains a great deal of deleterious matter, which water gas does not.

Mr. Burchard explained that such a gas is made by blowing an insufficient air supply through an incandescent mass of fuel, making a practically continuous process. A water gas cannot be made continuously. The effect of admitting a quantity of steam into a mass of incandescent coal in making water gas is to reduce the temperature. After a certain interval it is necessary to cut off the steam supply and blow up a heat as they say. Anthracite coal is the fuel used. The coal we use costs about \$4.75 a ton, and is a large-sized broken coal. Cheaper and smaller coal can be used in these producers by changing their construction somewhat. It requires careful adjustment of the supply of air and steam, and a slow rate of blowing to produce gas of 150-inch units without interrupting the blowing. The amount of producer capacity that we have in proportion to the quantity of gas is large. The air passes through the coal slowly, and a large percentage of the carbon is made into carbonic oxide. The producers are about 10 ft. deep, and are filled to within about one foot or two of the top.

In reply to a question by Dr. Emery regarding the blowing of steam through the fuel, Mr. Burchard said that there is a large amount of steam admitted with the air, which makes the gas somewhat richer by forming hydrogen, and also prevents the formation of clinkers, which is one of the difficulties in operating a gas producer. By regulating the quantity of steam the temperature of the producer can be kept at the most advantageous point. The air has to be put in at sufficient pressure to overcome the friction in passing through the fuel, together with the resistance of the pipes and the pressure of the holder. In our particular plant it requires about 6 in. of water pressure. It is necessary to use live steam.

THE CHAIRMAN: It is advantageous to use steam at as high a temperature as possible. I understand that Mr. Richmond has been experimenting with gas engines. We should be glad to hear from him.

Mr. Richmond explained that he had not been making experiments with gas engines but with oil engines. Having needed motive power for small refrigerating machines, he at first intended to use gas engines. While in Europe he found out that the gas engine is in some sense a back number; that is, in small powers up to 50 H. P. In its place he found that they were using oil engines. Upon his return he brought back several of them. At first it seemed rather extraordinary that American manufacturers were ignorant of the fact that all the makers of Europe were busy with oil engines. Afterwards it appeared that where gas is too expensive people were using gasoline, and that in Europe, the gasoline engine, after preceding the oil engine, had been put aside as soon as the latter had been developed. By an oil engine is meant an engine using a heavy oil, one flashing at about 100 degs. flash point. These engines will use oil at 100, 150 or even 300 degs. The reason that the oil engine has not been extensively used in this country seems to be that people use gasoline in place of it. In Europe, gasoline cannot be used in the cities, since it is absolutely prohibited by the insurance companies. In this country, a man who intends to use gasoline secures a license as a grocer to sell gasoline and sells it to himself, finding it a very good business. These gasoline engines are very much lower in price than the oil engines. Mr. Richmond gave it as his opinion that the oil engine is the engine of the future. He then introduced Mr. Lawrence Wildy, member of the English Institute of Mechanical Engineers and also of the German Society. Mr. Wildy represents Hornsby & Sons, of Grantham, who claim to have the best oil engine in the market. Mr. Wildy delivered a long address upon the subject of the gas and oil engines, from which we abstract the following:

I have had a very considerable experience with producer gas, water gas and illuminating gas in use with engines. Most of you probably know that the producer is an ordinary cylindrical vessel lined with fire brick and more or less intricate. The simplest producer I have ever used was a column of fuel about 10 ft. high. The fuel we use in England is coke, which is a residue after the distillation of the gas products. It makes the cost of the production of gas a mere cipher to the corporation running the gas plant. In Leeds the by-products are so valuable that the gas distributed throughout the city costs nothing in the holder. In fact it costs a decimal short of nothing in the holder. The company has nothing to do but distribute the gas and collect the accounts. We were using large quantities of gas at that time in the process of welding steel tubes of varying diameter from 20 in. to 60 in. and from $\frac{1}{4}$ to $\frac{3}{4}$ of an inch in thickness. Our gas bill was about \$30,000 or \$35,000 a year. At this time I got hold of the water gas process, as used in Germany, and the plant we put in was a success, since it reduced our gas bill to a little over \$5,000 a year, everything included. This was about one-sixth of what we paid before. That gas cost us on an average about 7 cents per 1,000 cubic feet. We made only water gas and got no by-products. In this process you simply consume the fuel in the blowing up process or in the cooling down process. Steam is injected, and the water is first dissociated into its constituent parts of hydrogen and carbonic acid, which latter parts with its atom of oxygen in cooling and becomes carbonic oxide. It then passes to the scrubber and is cleaned. After we had made water gas

for about 10 minutes, we used to blow the generator hot for 10 minutes with 16 or 17-in. water column air pressure. We then shut the air off from the bottom, shut the steam in at the top, blew down through that and produced water gas. But that water gas was produced for only a period of four minutes. After that we began to get an amount of carbonic acid in the gas which would have cost too much to remove, and, therefore, we thought four minutes sufficient. After the four minutes blow we turned our valves the other way and went on producing hydrogen and carbonic acid and then took the carbonic acid out and got pure hydrogen. We used this in water gas.

After this we began experimenting with the oil engine, a machine which works with the ordinary petroleum of commerce, that is, any of the lighting oils in the market. It also works with the heavier oils, up to a specific gravity of 0.9 and will work with an oil having a flash point up to 320 degs Fahr. The engine is provided at the back of the cylinder with a small cylindrical chamber called the vaporizer. Two valves open into this chamber, one inward and the other outward, which are the governor valves of the engine. The oil comes through one valve into the chamber, while any excess of oil is forced back to the tank through the other. The rest of the construction of the engine is almost identical with the gas engine. There is a lay shaft driven by a pair of skew wheels on the crank shaft, which lay shaft communicates motion first to the governor and then to two valves, one for the air inlet and the other for the exhaust. The air inlet cam at the same time operates a small pump from $\frac{1}{8}$ to $1\frac{1}{4}$ in. in diameter. The stroke of this oil pump can be adjusted by the regulation of a screw, so that the amount of oil injected into the vaporizer is exactly in proportion to the power required by the engine. This pump is best regulated by hand, but will be regulated by the governor under a varying load. The exhaust valve has a double cam by which a portion of the compression can be released when starting the engine. In starting the engine the vaporizer is heated with an ordinary paraffine lamp with a small fan attached, making a sort of petroleum forge. The vaporizer is heated in 5 to 10 minutes, after which you turn the fly-wheel and the engine starts at full power. The size of the heating lamp is so arranged that it burns just long enough to heat the vaporizer. The continual combustion of oil in the vaporizer restores to it the heat which has been used in vaporizing the oil and in the heating of the air necessary to produce the subsequent explosion. We have engines which have been running continuously for two months, day and night, without stopping, and the higher the work taken out of the engine the better the engine worked, very much better in fact than at low powers. The engines are started at 5:30 in the morning and are never looked at again during the day except when oiled at noon.

In reply to a question by Mr. Holloway, Mr. Wildy said that there was no residuum, in the cylinder, not so much after two months' running as could be wiped off with your hand.

Mr. Oberlin Smith asked concerning the efficiency of the various sizes of engine in fuel per H. P. hour, rating the oil at the same price as coal. Mr. Wildy replied: I can hardly give you that here. The consumption is about $\frac{1}{4}$ of a pint per horse power on all sizes of engine, being very little lower on the larger engines. On very small engines it will run to about a pint. A 16 H. P. engine uses just $\frac{1}{8}$ of a pint. In Russia they are adopting oil engines extensively, but with us the expense of the oil is an important factor. It costs us about 13 cents a gallon for that which costs about 7 cents in this country. The pressures in the oil engines are rather lower than in the gas engine, and they are consequently not so noisy.

DR. EMERY: I cannot see how you can pump the air into a hot chamber and let part of it run out without some danger of explosion.

MR. WILDY: The oil is injected into the vaporizer on the outward stroke of the piston while it is drawing air in. The oil, which has gone into the vaporizer, has gone in at a period of suction. Only a very small proportion of the vapor oil ever gets into the cylinder until the compression stroke comes on. At that point, owing to the compression and the temperature of the vaporizer, the explosion takes place and the impulse is given to the engine. The explosion is obtained at the right moment by careful adjustment of the exact capacity and temperature of the vaporizer. The continual combustion of the oil maintains the temperature of the vaporizer. Its temperature is about that of melting tin.

With gas at two shillings per 1,000 ft. we run rather more cheaply than with oil. Gas engine makers who claim to use only 14 to 18 cu. ft. per horse power will really use 25 to 30 in regular work, and with producer gas 90 to 100. It is necessary to provide an attendant for the producer and for the boiler, and there is much more plant necessary for the gas engine than for the oil engine. In answer to a question Mr. Wildy explained that the temperature of the vaporizer and the compression of the mixture was what caused the explosion. This compression is varied to suit different kinds of oil and is adjustable upon each engine. Russian oil requires 25 to 30 per cent. more compression than American oil. It does not matter what the temperature is, provided it is not below 400 deg. The instant the oil enters the vaporizer it becomes vaporized.

A written discussion was contributed by Mr. Paul Winand, Superintendent of the Otto Gas Engine Works at Philadelphia. Mr. Winand said, among other things:

Concerning gas lighting with the new incandescent burner I know from experiment that producer gas does not give a high enough temperature. Electric lighting is generally the best possible way to provide light in a gas plant. Pure water gas can well be used with these burners, but it is more expensive. It is generally thought that by increasing the number of impulses the regularity of motion thus secured would greatly improve the gas engine. Considerable experience has shown me that to complicate the construction to get more than one impulse from each revolution is not advantageous. The Otto engines at Danbury tested by Mr. Burchard were used with both producer gas and illuminating gas, and it is easily understood that in their construction a compromise had to be resorted to, which prevents their giving the best efficiency with either gas. Up to this time it has been customary to use a steam boiler in connection with the producer. This is not a necessity; we operate at our works a producer plant without a boiler. The necessary amount of water vapor which passes through the producer along with the air is generated at atmospheric pressure by means of the waste heat of the gas as it leaves the producer. This makes it unnecessary to use additional fuel for producing steam. Mr. Winand said that gasoline engines are much preferable to oil engines, and that therefore the demand for the latter in this country is very small. The provisions for the safety of gasoline engines are so absolute that insurance companies do not object to their use. Oil engines are not ready for starting when wanted, and are naturally wasteful when running at partial and variable loads. This is because the proper temperature is not maintained at the different loads which occur in practice. Where a continuous external flame is used for maintaining this temperature, the fuel consumed by the flame decreases the efficiency at reduced loads. Oil engines are more complicated, more expensive and less convenient than gasoline engines, and unless there should be a marked difference in the prices of the two fuels the latter would seem preferable in most cases.

The Standard Automatic Brake-Slack Adjuster.

This simple and well-designed brake-slack adjuster will not only take up the slack in the brake rigging, but will regulate the piston travel at the same time. The slack is taken up without regard as to the cause, whether by worn brake shoes or worn pins in the levers, strained brake beams or bent levers, and does the work automatically while the car is in motion.

Fig. No. 1 shows the adjuster complete for a single car. It is made of malleable iron, and consists of two levers,

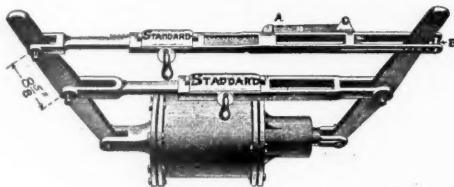


Fig. 1.

the upper one being the adjuster proper, and the lower one taking the place of the ordinary fulcrum bar, the same pins and holes for the latter being employed. The adjuster bar is fastened to the left-hand cylinder lever by a pin 8 $\frac{1}{2}$ in. from the fulcrum rod pin. The other end of this bar forms a guide in which the right-hand cylinder lever travels, a pin in the lever extending through the slot in the bar to keep it in position. This bar consists of two pieces, one having ratchet teeth and the other being a casing carrying the pawls and locking device A. These are better shown in Fig. 2. It will be noticed that these ratchet teeth for the lock A extend in an opposite direction from those engaged by the pawls. The lower bar is of similar construction but contains no lock.

When the brake is applied the right hand cylinder lever moving in the guides of the adjuster bar unlocks A, and the adjuster is shortened till the brakes are fully

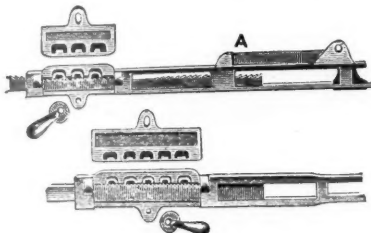


Fig. 2.

applied. Then when the brakes are released, and supposing there to be some slack, the piston on returning to its original position will shorten the fulcrum rod, thus taking up the slack. The pin B regulates the piston travel and may be placed in any of the series of holes shown. When it is necessary to create slack for the purpose of putting in new shoes, etc., the pawls may be disengaged by the small levers with cam attachments; these levers returning to their original position by gravity, as soon as released, and the pawls again engaging the ratchets. In a few applications this slack will be taken up, no adjustment being necessary.

This device is manufactured and sold by J. H. Sewall, of Portland, Me.

Diminished Profits and the Remedy.

The annual address of Colonel Haines, President of the American Railway Association, at the meeting held in St. Louis this week, was largely statistical. It was designed to show that the railroads are in a very bad way, and to point out some possible remedies. To be a little more specific, the main propositions were that:

In the freight business, rates have fallen faster than the cost of service, and apparently even the volume of business has begun to decline, so that we cannot hope to continue to make money at diminished rates. If further reduction is to be made in the cost of service it must be in wages. If wages are not to be seriously reduced, rates must be raised, and rates can be raised and maintained only by the legalization of some kind of pooling and by holding railroads which violate their agreements to legal responsibility.

From passenger business there is no profit to the railroads of the country in general, and here also wages must be reduced or rates must be raised, or a margin of profit must be created by reducing the cost of service. Colonel Haines does not suggest raising the passenger rates, but that cost of service can be reduced by reducing competitive train service and thus increasing train-mile revenue.

We shall not attempt to give at much length the many figures brought forward to support these propositions. These figures are drawn mostly from the reports of the Interstate Commerce Commission.

In the six years from 1888 to 1893 the revenue per ton-mile fell 12 per cent., the cost 8 per cent. and the profit 19 per cent. Or, to put it in another way, we have given to the public not only the entire result of our economies and improved methods of operation, amounting to .051 cents per ton-mile, but also .072 cents besides, or nearly 150 per cent. more than the decrease in cost, and it is about time to call a halt in this race toward zero. While the ton-miles carried increased 11 per cent. in 1890 and 6 per cent. in 1893, the preliminary report of the Commission shows a decrease of 17 per cent. in 1894 as compared with 1893. This, it must be remembered, is, however, only a preliminary report, and for less than 150,000 miles of railroad. The percentages of increase and decrease in ton-mileage and gross and net freight earnings for several years are given in the table below. The strange fluctuations in the last column are attributed to changes in rates.

	Ton miles. Increase.	Gross. Increase.	Net. Increase.
1889.....	11 per cent.	13 per cent.	14 per cent.
1890.....	6 "	1.2 "	1.5 " (dec.)
1891.....	9 "	9 "	10 "
1892.....	6 "	3.7 "	0.3 "

From 1889 to 1893 the traffic and the net returns per mile of railroad increased, but the ratio of net revenue has been maintained by economies, which cannot be much augmented except from some new source; and so far as can be seen now the results for 1894 will be found to have been much worse than for any year since the Commission's statistics have been collected.

Taking the passenger traffic and comparing 1889 and 1893 the revenue per passenger-mile has fallen 2 per cent., the cost has also fallen 2 per cent., and the net earnings have fallen 10 per cent., or, as with the freight rate, more has been given away than has been saved in cost, but passenger rates have been much better maintained than freight rates. The passenger traffic increased in volume from 1889 to 1893 about 5.3 per cent. per annum, and even comparing 1894 with 1893 there will probably be a very slight increase.

Considering again the freight traffic, the question for the traffic managements to answer is whether they were justified in reducing rates so much faster than the operating managements could reduce cost as to reduce the net rate nearly 10 per cent., comparing 1889 and 1893.

Grouping the Commission's figures it is found that the reduction in cost of handling freight has been 13 per cent. in maintenance of way, 4 in maintenance of equipment, 2 in conducting transportation, and 2 in general expenses. The cost of conducting transportation, which constitutes over one-half of the total, shows but slight reduction, and this includes the wages of the great body of railroad men; and here is the item in which any considerable reduction in the cost of operation must hereafter be made.

The conclusion of Colonel Haines' address is as follows:

The pressure to reduce rates is applied from two directions; on local traffic, from State Railroad Commissions, where they control rates, and on competitive traffic, from unregulated competition. Unwelcome and irrational as may be the exercise of the rate-making power by State Commissions, the evil effect upon the welfare of our railroad system from this cause is not to be compared with the injury growing out of the denial of the right to make contracts for the division of competitive traffic.

It is for the protection of the smaller shippers and for the weaker railroad companies that contracts for maintenance of rates of division of revenue should be legalized, and that the offending railroad managements should be amenable in the courts for the injury occasioned by their disregard of their plighted faith. When this is done secret rebates will cease, because there will be no longer any advantage in granting them, and the corrupting influences which with unrestricted competition pervade our railroad corporations will be greatly diminished in virulence.

The difficulties in the regulation of passenger traffic are of a different character. They arise mainly from

the extravagance which is general in the conduct of the service. Luxuries in the way of sleeping cars and dining cars are provided where the revenue from the passengers so accommodated does not justify the railroad companies in furnishing them, and the passenger who rides at night in the day coach and snatches his food from a lunch counter pays out of proportion for what he gets.

The remedy lies in reducing competitive train service and by so doing to increase the revenue per train mile. It is not the increased rate per passenger mile that adds to the net revenue of a railroad company, but the increased returns per train mile.

The lavish distribution of free passes is also an abuse which results in a loss of net revenue that might readily be secured by joint action on the part of our railroad managements, but no single management can cope with it.

The Sprague Electric Locomotive.

We show this week an engraving from a photograph of the electric locomotive just completed at the Baldwin Locomotive Works after designs by Messrs. Sprague, Duncan & Hutchinson. It is intended for special experimental work in handling heavy freight and in switching, and was built for the North American Company for this purpose. The locomotive resembles somewhat the ordinary consolidation type used for heavy freightyard work. There are four pairs of drivers coupled together by quarter-ported connecting rods. The frame and the superstructure are symmetrical and the former is provided with freight buffers and iron pilots. The pedestal boxes are a special form made of cast steel and project inward, forming the brackets which carry the motors. The lower sides are arranged to be dropped out, so that the brasses can be readily replaced in the usual manner. These boxes are very large and heavy and perform the duty of carrying both the axles upon which the armatures are rigidly mounted and the field magnets concentric to them. A stirrup projects from the upper part of each to engage

in the Westinghouse-Boyden case, which we printed in a recent issue. The pamphlet contains the following preface, which gives the first warning, we believe, that railroad companies are likely to be held responsible for their use of infringing apparatus.

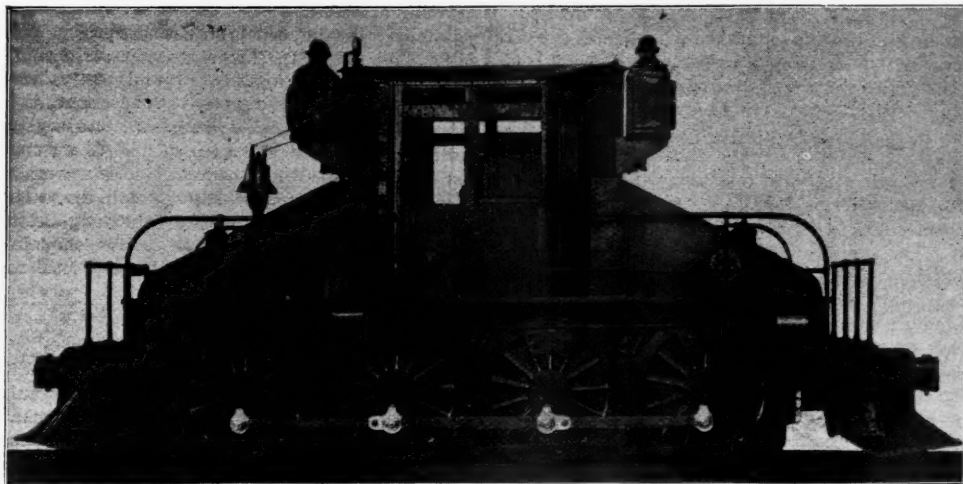
We publish the fifth successive decision of the United States Courts, establishing the scope and affirming the validity of the Westinghouse quick-action air-brake patents.

The first of these decisions was generally regarded as a determination of the intrinsic merit of the quick-action invention, in view of the prior state of the art, and of the validity of the patents which had been granted for that invention. The latter decisions may be properly regarded as more comprehensive definitions of the scope of the invention and of the length and breadth of the territory in the air-brake field, to which the Westinghouse patents give a title. The decision of his Honor Judge Morris, presented herewith, sweeps away the last of the cobwebs which obscured a clear view of our exclusive title to every quick-action air-brake which operates by a double traverse of the triple-valve piston, regardless of the number or arrangement of pistons, valves or other parts.

A reading together of the various decisions of the courts fully confirms our former statement, that any quick-action air-brake offered to the public by others than ourselves, and which is capable of working interchangeably with ours, is an infringement of one or more of our patent rights.

Prior to the rendering of the first decision, it appeared to some that differing individual opinions concerning the questions at issue were entitled to equal weight. The decisions of the courts, however, fully justify our often-repeated statement that our exceptional experience in the air-brake business and our intimate acquaintance with the development of the art enable us to accurately estimate the merits of the situation, and entitle our statements to greater consideration than those of novices in the business, who have no established reputation to maintain, and who view the situation through the narrow crevices of inexperience and cupidity. We therefore feel justified in once more calling the attention of railroad officers to the facts of the situation, which are as follows:

There are two distinctly characteristic features of the quick-action air-brake. They are, first, the practically instantaneous application of the brakes to all the cars of



Sprague 67-Ton Electric Freight Locomotive.

the middle section of the inverted elliptical springs. There are four sets of springs arranged on the double three-point suspension system. In this way the whole superstructure is carried on equalizing springs. The drivers are 56 in. in diameter, the end ones only being flanged.

The motors, four in number and alternating in position, are the "Continental" ironclad type, the field magnets, consisting of two steel castings, having two field coils placed at the ends of the motors; thus forming two consequent and two salient poles. The magnets are compound wound. The armatures, which were built by the Westinghouse Co., are of the slotted type. The motors are wound for 800 volts at 225 revolutions, which equals about 35 miles an hour when in multiple. About 250 amperes of current will be used, and, at 93 per cent. efficiency, each motor will give about 250 H. P. There will be a constant drawbar pull of over 10,000 lbs. To effect the prompt operation of the controlling system, compressed air from the air-brake tanks is used. It is kept at a constant pressure by a special electric pump. The cab is provided with ammeters, voltmeters, whistle, bell, headlight, etc. The American driver brake is applied to every wheel. The cab, as seen from the photograph, is centrally mounted with wedge-shaped ends and forward-inclined sections running down to each end of the locomotive. The controlling apparatus in the cab is so arranged that the engineman sits at the right side looking forward, no matter which way he is normally running.

The total weight of the engine is about 134,000 lbs., equally distributed upon drivers. It is at present standing in the erecting shops of the Baldwin Locomotive works where it has been tested by Dr. Duncan and Dr. Hutchinson. It is possible that it may be taken to Baltimore for actual work in the near future.

The Latest Air-Brake Decision.

The Westinghouse Air-Brake Company has published in pamphlet form the text of the opinion of Judge Morris

a train in emergencies, and, second, the application of a greater pressure of the brake-shoes in emergencies than is either necessary or safe in ordinary service applications of the brakes. No air-brake can be made acceptable for general service without embodying in it both of these features. We unqualifiedly assert that the right to make, sell or use any form of air-brake which performs these essential functions is vested exclusively in the Westinghouse Air-Brake Company, and that the patents which we control guarantee full protection for our rights.

More than 400,000 freight cars are now equipped with the Westinghouse quick-action brake, and this type of brake has practically become the standard upon nearly all of the principal railroads of this country. A few railroad and private car companies have, however, been induced to purchase inferior and infringing brakes, regardless of the fact that the use of even a limited number of these devices seriously affects the efficiency of the standard apparatus, and also compels all those railroad companies which recognize the importance of maintaining a standard brake, to carry an increased stock of air-brake repair material for the purpose of maintaining these different kinds of brakes, forced upon them in interchange traffic, thereby introducing great confusion and increasing the cost of maintaining the brakes in working order. It is absolutely necessary, for the protection of the interest of those who are large owners and users of quick-action air-brakes, that this illegal interference with our rights and the accompanying depreciation of the value of the investment made by the railroads in air-brakes, shall be terminated as quickly as possible.

It has been the policy of this company to abstain from litigation with railroad companies which have purchased infringing brake devices, until our claims were established by the courts through suits brought against the original manufacturers and vendors; but, in view of the character and extent of the rights which the courts have now established for us, we expect these rights to be promptly and fully recognized. We shall therefore be prepared to replace infringing devices with our standard apparatus upon terms which we feel quite sure will be recognized as extremely liberal. If within a reasonable time, however, this reminder fails to secure proper recognition on the part of the railroads which have purchased infringing apparatus, we presume that no offence will be given if we resort to the usual legal remedies of an injunction and an account.

The Car Fender in Baltimore.

"Rapid transit" was introduced in Baltimore in May, 1891, and not until January, 1895, were fenders generally adopted. During that period 82 lives were lost and nearly 300 persons more or less injured. Among those killed or fatally injured 35 were children, 16 were old people, and 31 were persons between the ages of 15 and 55. From evidence submitted at inquests it was shown that 11 persons killed were under the influence of liquor. Fourteen fatalities occurred from men and boys attempting to board the cars while in motion, and eight others resulted from attempts to jump off before the cars stopped. Twelve persons were fatally injured by cars coming in collision with vehicles in the street, and 48 were knocked down by cars and crushed under the wheels. In 56 cases coroners' juries exonerated the grip-men and motormen, and in 26 cases no opinion was rendered. In 23 instances evidence showed a measure of blame on the part of the road employees in not keeping their cars under control, and in 42 cases death was clearly the result of carelessness on the part of the victims, while 17 of the fatal casualties were purely accidental.

Legislation by the city council to regulate the speed of cars and to enforce proper precaution on the part of the companies began early. One of the first measures was for all cars to stop on the near side of the street approached, and to stop at all junctions and crossings until the track is seen to be clear. While there are more than 100 crossings and junctions in the city, only six collisions between cars have been recorded, in which not a single life was lost.

Ordinances looking to the adoption of fenders were passed in 1892, one measure approved in February of that year requiring side guards to trailers, which put an end to one class of casualties. In 1893 the question of choosing a fender for all the street cars of the city was entrusted to the Street Commissioner, who was to act in conjunction with the Mayor and City Solicitor. But after carefully examining various devices this official failed to make any report, preferring not to assume the responsibility of recommending an appliance which might not meet public expectations.

Finally, in 1894, the matter was submitted to a special commission which employed Mr. Mendes Cohen as engineer to investigate different styles of fenders and report on them. In brief his recommendations included a fender in front of the car and a guard immediately in front of the wheels. An abstract of this valuable report appeared in the *Railroad Gazette*, Sept. 21, 1894.

Since January last, 16 persons have been picked up by the fenders. In only one instance has there been any serious injury, where a boy, 10 years old, was caught so that his leg was broken. One child was missed by the fender and saved by the wheel guard, and one demented woman who sought death by throwing herself on the track in front of an approaching car was saved with only a few scratches.

An English Signal Wire Carrier.

The engravings shown herewith illustrate a signal wire carrier, recently brought out by Saxby & Farmer, of London, and described in a recent number of *Engineering*. Two types, varying slightly in detail, are shown by the engravings, in which Fig. 1 shows a side wheel for attaching to wooden stakes, and Fig. 2 is a convertible pulley for attaching to iron stakes and can be used either as a fixed side wheel or a swivel angle wheel, as necessary. A modified form of Fig. 1 forms a swivel angle wheel for attachment to wooden stakes. When the split pin in Fig. 2 is in place, as shown in the illustration, the

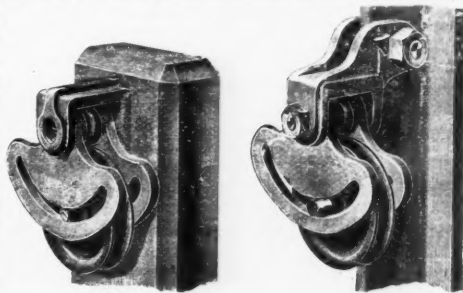


Fig. 1. Signal Wire Carrier.

Fig. 2.

frame which carries the wheel is fixed, and when the cotter is removed the frame can swivel, and thus the wheel accommodates itself to the curve on which the wires are laid. In operation the wheel revolves, and in doing so displaces the segmental arms or links; friction is thereby greatly reduced, and the working of the wires rendered very easy. The wheels being mounted in the segmental arms with the radial slots always hang perfectly vertical, however the stakes may get out of the perpendicular, and this is a great advantage, as it insures the wire always running properly in the groove of the wheel. These carriers can be adapted to existing standards and frames.

Railroad Building in Guatemala.

Advices from Guatemala report that on March 15 the first 40 miles of the Northern Guatemala Railroad were opened to the public from Puerto Barrios to Los Amates, and two trains are now running daily in both directions. By the end of the year Silvanus Miller, the contracting engineer, expects to have 80 miles completed and in operation. This railroad is being built by the Guatemalan Government, but most of the material comes from the United States.



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EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

The reported gross earnings of the railroads for the month of March show a little improvement. The gain is but trifling, but still it is a gain. The *Financial Chronicle* reports a gain over March of last year of $\frac{1}{4}$ of one per cent. for 132 roads. *Bradstreet's* reports a gain of $\frac{1}{10}$ of one per cent. for 129 companies. Of course the comparison is with a very lean month, the loss in March, 1894, having been 13.05 per cent. February of this year showed a loss of a little over 2 per cent. as compared with last year, and for the year from Jan. 1 the loss is about $\frac{1}{4}$ of one per cent. Of course so slight a gain as is shown for March cannot be taken as indicating a permanent turn for the better, but it does give us a little hope. As heretofore, the grain carriers and the roads serving the country where the corn crop failed are the chief sufferers. In *Bradstreet's* analysis the granger roads showed a decrease of 8.2 per cent. The coal roads were next with a decrease of 7.6 per cent.; then the eastern roads with a decrease of 3.8. The greatest increase is in the southwestern roads, 4.2 per cent. The central western and the trunk lines were the other groups which had increases. Of individual roads the Great Northern showed the greatest increase, namely, \$188,000; the Missouri, Kansas & Texas comes next with \$184,000 and the New York Central with \$171,000. The greatest decrease was the Rock Island, namely, \$314,000; next came the Milwaukee & St. Paul with \$260,000; then the Canadian Pacific with \$193,000.

It appears that in the Trunk Line eastbound freight agreement of April 9, there was a clause by which the Chicago eastbound roads, which shall have overrun their proportions on April 30, bind themselves to deposit with Commissioner Blanchard, of the Central Traffic Association, the sum of \$2 a ton on such excess, to be held by him until the business for May is reported. If at the end of May the roads that fell short of their proportions shall not have evened up their allowances, then the Commissioner is authorized to pay them \$2 a ton on such deficits. It is said that the Commissioners are at work on the preparation of an agreement under which each road will give bond to carry only its allotted proportion of eastbound freight. Any excess carried by any road would be to that extent a violation of the contract, for which a money penalty would be exacted. The two-dollars-a-ton arrangement seems to be an experiment to aid in determining what shape the details of the agreement ought to take. In view of the very great difference between promise and performance, often observable in Western traffic agreements, it will, perhaps, be soon enough to criticize this latest move when it shall prove to have amounted to something; but on the surface it seems to be making an unnecessary quarrel with the fifth section of the Interstate Commerce law. In discussing the Cincinnati Freight Bureau case, May 29, 1894, the Interstate Com-

merce Commission said (case 322, head notes, paragraph 7):

The "fines" or "penalties" imposed by the provisions of the agreement of the Southern Railway & Steamship Association on members for violation of association rules appear on the face of that agreement to be available as substitutes for payments which would be exacted under a regular pooling system, and the arrangement under which they are imposed is tantamount to a combination, contract or agreement "for the pooling of freights of different and competing railroads, or to divide between them the aggregate of net proceeds of the earnings of such railroads or any portion thereof," which are forbidden by the Statute.

This seems to be a reasonable finding, and it would apply with equal force to the present Chicago agreement. But as every fair-minded and well-informed business man now agrees that railroad pooling will not violate a sound public policy unless it actually does raise rates to an unreasonable figure, and as there is no prospect that the Chicago roads will come within a thousand miles of accomplishing that result, we can afford to wait and see.

In our last issue we noted some bad train accidents, a worse list, indeed, than before in a single week for several months, estimating by the fatality of the results. One peculiar one was omitted, however. It was on an electric line, and does not come within the regular category of railroad train accidents, but it should be noted, for it shows what we may expect if the electric lines are to be permitted to continue to run on the go-as-you-please plan. This was a butting collision, on the Camden, Gloucester & Woodbury railroad at Gloucester, N. J., and was caused by the bad judgment of a motorman in approaching a meeting point too rapidly. It appears that the bridge over Newton creek is too narrow for two tracks, and so the two main tracks are interlaced, or laid very close together, for a sufficient distance to get both across the bridge; and this makes practically a piece of single track, as far as the right to the road is concerned. Now, in pursuance of a thrifty desire to give the public "rapid transit," and compel the ancient steam locomotive to retire from the field, this road has put in service two heavy cars, with powerful motors, which can be run at 35 or 40 miles an hour (and they are thus run); and one of these cars smashed into another at this bridge, wrecking both of them and injuring four passengers. The other occupants escaped by a narrow margin, the reporters say. The significant point in this occurrence is that the company was trying to accomplish standard railroad results by street-railroad methods. One great difference between the trolley lines and standard railroads is that the latter can safely run much faster than the former, perhaps twice as fast, and one great element in this superiority is the years of training that the passenger runners on the latter have had. But here is a new road, with new men, only partially realizing the dangers to be looked out for in moving heavy bodies at high speed, and passengers innocently entrust their lives to them, with no thought beyond the saving made in money and time by using the new line. Apparently the lesson learned by locomotive runners between 1825 and 1840 about the elements of safety in running trains on single track are to be learned over again. Legislators and others having to do with the powers and privileges of street railroads should note this condition of things, for the first argument in favor of electric street lines is their cheapness, and in the particular matter that we are now considering the cheapness is secured by hiring motormen at \$2 a day instead of paying \$4 for men who have learned the lessons of the experience we speak of.

The Connecticut Railroads and the Public.

The people of Connecticut appear to be getting quite well acquainted with the pros and cons of the trolley-competition question. The Central Railway & Electric Company, which desires to build a street railroad from New Britain to Hartford, presented its application to the Superior Court last week, and was refused the desired certificate that the public need and convenience demands the construction of the track. The law governing this matter was passed in 1893, and provides in substance that no street railroad shall extend its lines from one town to another in the public highways, so as to parallel any other railroad (steam or electric), without first obtaining a finding from a judge of the Superior Court that the building of such a road is a public convenience and necessity. In this case the court (Judge Hall) finds, in substance, that there is no wayside passenger traffic worth mentioning between New Britain and Hartford; that the object of the incorporators of this company is mainly to carry passengers through between the two cities, and that the New York & New England Railroad already provides all reasonable accommodations for such passengers. Another application of the same company was approved.

It would appear from this case that the New Haven

company need have no fear that new concerns, introducing unfair competition, will get any undue advantage through the general law, but only by special charters; so that if the officers of the New Haven road could get the Legislature to adjourn and go home, they would be all right until the next session. The Superior Court is a conservative tribunal and may be expected to grant certificates of exigency for new roads only where the public interest demands them. Perhaps, however, the New Haven's anxiety is like that of a certain Irishman in a criminal court, whom we read of in the modern American classics. While waiting for his case to be called, he took on so incessantly that the judge was moved to pity and tried to soothe him with the assurance that he need have no fear, that justice would be done. "Yer anner," said Pat, "that's just what I'm afraid of."

The company which proposes to build an electric passenger line between New Haven and Derby finds itself blocked by another clause of the general street railroad law of 1893. This company naively came before the authorities with the statement that its line would lie mostly on land which had been bought by the company, outside the highway; but it appears that the project might have stood a better chance if it had stuck to the highway, for the law is confined in terms to companies chartered for the purpose of operating street railways. Going out into the fields makes it necessary to act in accordance with the general railroad law, under which the stock must be at least \$10,000 a mile, subscribed by responsible persons, and 10 per cent. paid in. The application for approval must be accompanied by a complete engineer's report, and there are other conditions which bear pretty severely on any light-weight concern.

These two decisions, with the law forbidding grade crossings place serious obstacles in the way of the alleged general scheme to spread a cobweb of street railroads throughout the State of Connecticut. But they are plainly just, and they can do no harm to a project which the public really needs. If there is a "general scheme"—an agreement among capitalists to build street railroads in Connecticut just because it is Connecticut, or because there is an old railroad which has done a large and profitable business in the State, such a scheme ought to fail. Railroads which cannot run cars faster than 25 miles an hour, and which lay their tracks on 4 per cent. grades, cannot expect to do long-distance passenger business, and therefore cannot complain at being classed as local roads; and every local road should stand or fall on its own merits.

Reorganization of Atchison.

For the third time within six years a reorganization scheme is put forth for the Atchison, Topeka & Santa Fe Railroad Company. Of these three schemes, the first (1889) and the third (just issued) have been made necessary by bankruptcy. No adequate reason has ever been given for the second reorganization, by which the contingent charge of an income bond was exchanged for the fixed charge of a second mortgage. The reorganization scheme of 1889 was thoroughly objectionable, and the present plan has some of the same defects.

But the plan now put forth, while not ideal, and, indeed, while not fundamentally sound in principle, has the great merit of immediate expediency. First of all, it is likely to go, and that is a great thing. The property is so vast, the volume of securities is so great and so widely distributed, that it will be a relief to the market to get these affairs settled and the property again in working order in any reasonable way, although it may not be the best way; and we suppose there is little doubt that the plan of the committee will go through, for a contract has already been made to secure the payment of the assessments on the stock. Moreover, the scheme attempts to give to all of the present security holders an opportunity to make some salvage out of their property, and human charity may be extended even to security holders. Moreover, the plan will wipe out the floating debt, will provide for future additions to capital, and will reduce the fixed interest by nearly 53 per cent. and bring it within the calculated earning power of the property.

The reorganization of 1889 had two very grave defects. It was neither honest nor expedient. It was not honest because it failed to recognize the value of liens, and with some minor exceptions treated all bonds alike, having regard only to their rate of interest, neglecting the security and the time they had to run. It was inexpedient because after it was carried through it left the control of a great property in the hands of an irresponsible body of stockholders, through the voting power of a stock which was never likely to earn an honest dividend, and whose only value lay in its power of control. The methods by which this reorganization was put through were as questionable as the plan itself; but bondholders generally found it

expedient to make the exchange, while the more conservative sold their new issues as soon as received. A few bondholders never exchanged their bonds, and after some delay collected their old coupons.

One result of this reorganization was an enormous increase in the nominal capitalization. The following figures, taken from the Investors' Supplement of the *Financial Chronicle*, show the capitalization of the company shortly before and shortly after this reorganization, and also at the beginning of 1894:

Security.	July 1889.	January 1890.	January 1894.
Mortgage bonds.....	\$130,698,000	\$149,234,750	\$227,384,320
Income bonds.....		78,243,314	
Common stock.....	75,000,000	75,000,000	102,000,000
Total.....	\$205,698,000	\$302,478,064	\$329,384,320

It is true that this reorganization did not increase the interest charges, and made a portion of them contingent; but it placed nearly \$100,000,000 of additional principal ahead of the capital stock, and deprived that stock for a century of all the benefit it might have expected from the refunding of indebtedness at diminished rates of interest.

In January, 1894, the capitalization of the company was as shown in the table above. The Atchison, Topeka & Santa Fe had acquired by purchase two other railroads and by the purchase of one of these had become the sole owner, instead of the half owner, of the Atlantic & Pacific. While the wisdom of these purchases is not clear, they do not affect the present reorganization scheme. The scheme as put out simply relates to the parent corporation, a contingent provision being made for the securities of these controlled railroads; but the scheme is complete without them. If the scheme goes through it is still possible that the only effect of these purchases has been to add \$27,000,000 to a capital stock which can never expect to earn an honest dividend.

On this basis the company went into the hands of receivers, and a subsequent investigation showed the most disgraceful falsification of accounts which has ever been brought to light in the affairs of an American railroad, a fearful warning of the possibilities under an irresponsible management.

The only merit of the reorganization of 1889 was that the fixed charges were brought within a limit which it was believed could be safely earned. In its anxiety to give an apparent value to the junior securities, the management adjusted its reports so as to pay unearned interest on income bonds and give a market value to an utterly valueless stock. The results are known; they need not be repeated now. There is a grim satisfaction in knowing that the management which did these things was controlled abroad.

The basis of the new reorganization scheme is one which has characterized English management of American corporations and is very unlike the plans formerly followed. The peculiar feature is expressed in the statement that one end proposed is to "restate existing securities upon equitable terms in their order of priority." This is the tribute to expediency by which the plan may sail through smoothly, but which contains possibilities of great trouble in the future. This idea has been the basis of nearly every reorganization conducted under English auspices; and it is responsible for such wrecks as the Erie and other railroads which have passed under English control. It is wrong in principle, and, of course, dangerous in practice. No securities ought ever to be issued by any corporation unless those securities represent what they pretend to something which may expect to give a fair return on its nominal value. The law of real property allows an equity of redemption for a reasonable length of time; this system of preserving old securities in the order of their priority amounts to a perpetual extension of this equity of redemption and often confers on its holder the right to manage a property which he has forfeited. The real owner loses the inducement of unrestricted ownership, to improve and care for his own, and the holder of the deferred security is condemned to the eternal punishment of everlasting disappointment.

The following table shows the present capitalization of the company and the capitalization as it will exist if this reorganization scheme is carried out:

Security.	Existing.	Proposed.
Mortgage Bonds.....	\$232,341,641	\$112,073,946
Income Bonds.....	1,253,607	51,723,302
Preferred Stock.....		111,483,951
Common Stock.....	102,000,000	102,000,000
Total.....	\$335,595,248	\$377,288,199

The mortgage bonds are cut down to a sum on which it is reasonably certain that interest will be earned, about \$4,500,000 of net earnings being all that is required for this purpose. The income bonds (termed adjustment bonds) will bear the same rate of interest, four per cent., and to provide for both classes of bonds will require about \$6,500,000, which there is a reasonable chance of earning. The capitalization is increased by \$42,000,000, all of which is in

bonds or preferred stock, and the common stock is shoved that much farther into the desert of blasted hopes. The preferred stock is to be preferred at five per cent., thus requiring over \$5,500,000 to pay dividends. Before a dollar will be available for dividends on the common stock more than \$12,000,000 yearly must be disbursed to bonds and preferred stock. This is twice the amount which it was considered safe to become responsible for in the reorganization of 1889, and nearly three times the amount which it is considered safe to become responsible for now. It is one-half greater than the net earnings reported by Mr. Little for the very prosperous year of 1893.

The control of the railroad is left in the hands of the two classes of stockholders, the preferred being slightly in the majority, but a preferred stock which is not likely ever to earn honestly more than two per cent. dividends, and a common stock which will never earn anything honestly, cannot have the responsible character which should be trusted. As such stockholders will have no inducement to manage the property for the security of an investment which yields no return, they may be expected to follow the example of the last few years, and endeavor by unfair means to give a fictitious value to a property which they can realize upon only by selling.

The scheme proposes to raise about \$10,000,000 by an assessment of the stockholders, giving these stockholders in return for such assessment an amount of preferred stock equal to the assessment paid. This is perhaps the worst feature of all. It is obtaining money under false pretences. As an inducement to the present stockholders to save their stock, they are invited to pay for a preferred stock which is not likely to be worth on its merits more than one-quarter of its cost, when there is no possibility of the common stock which is saved ever having any value except for gambling. Before the troubles of 1889, the stock of the Atchison, Topeka & Santa Fe was largely held by small investors in New England. There is many a family to whom these disasters have made the difference between comfort and penury, and yet many of these people still hold their stock. The new scheme comes to people of this class, as well as to the large and speculative holders, and asks them to squeeze and pinch to raise a little money, on the ground of some future benefit, which they will ignorantly expect, but can never realize.

It is said that the \$10,000,000 subscription has been underwritten by parties who will take the new common stock and preferred stock if the old stockholders do not come in, and this is considered an assurance of the success of the scheme. The inducement to the bondholders to come into it is that they will have the benefit of the money raised by assessments, and, in consideration of this, they are asked to forego their legal right to take the whole property; if they accept this contribution from the stockholders, they forfeit the right to control a property which really belongs to them, and which in their hands would have a responsible ownership.

So the best that we can say of the new scheme is that it has immediate expediency, and that as a piece of financial temporizing it is ingenious and able. But it has the serious defects that it endeavors to raise a large contribution on the pretense that the stock which the stockholders will save by an assessment has a value, and that it leaves the control of the railroad in irresponsible hands. It will probably result in the continued rolling up of immense amounts of paper securities whose principal value will be in their capacity to earn commissions. The sweeping, fundamental measure of an old fashioned foreclosure, wiping out fictitious values would have been the most merciful in the end; but, perhaps it would have been too cruel.

A Case of Narrow Gauge.

During the past 12 years nearly 10,000 miles of narrow-gauge railroad belonging to 150 separate companies, have been either converted to standard gauge or abandoned entirely, in the United States alone.*

The construction and equipment of these roads, including interest and promotion expenses, probably cost, on an average, \$8,000 per mile, some of which is represented in roadbed of the converted lines; the remainder is lost. To this sum is to be added the loss in direct operation, which eventually led to their extinction or conversion, for which we have no figures, but which, on a moderate assumption would bring the total loss, in the above period and in round numbers to \$10,000 per mile, making the aggregate cost of the narrow-gauge fallacy in the United States, say \$100,000,000. This is a guess, of course, but probably rather under than over the real figure.

It seems inexplicable, in the light of the past, that

* See discussion by Foster Crowell, C. E., World's Fair Engineering Congress, Transactions Am. Soc. C. E., Vol. XXX., December, 1893, p. 339.

necessity should still exist, for exposing the narrow-gauge error, but our cousins in England may, from their inexperience, require special treatment before they get through with the "light railways" episode. The paper on the United Verde & Pacific Railway, which we reprint in part in another column, serves to point our moral, and it will also adorn the tale, for it is an able paper and contains valuable suggestions in the art of railroad-building in detail in a remote and difficult mountain country.

The line was built not as a venture, but to directly save the excessive cost of wagon-haul to and from its owners' mines, and, therefore, presumably, on a demonstrated scheme of greatest economy. The demonstration is not given, but instead there is a very interesting argument for adopting a narrow (3-ft.) gage, in face of the fact that the distance is but 26 miles, the only rail-connection is standard gage and all the traffic is through business, extremely limited both as to daily tonnage and duration. The argument we consider fallacious.

It is true that this is an extreme case and contains some unique features; but there is only one cogent reason, if any, to justify the narrow gauge, and, strange to say, it is not offered as a reason, although mentioned as a condition. Briefly stated, it lies within the fact that the entire daily traffic, present or prospective, is less than the daily capacity of a single train and crew—that is to say, the road is 26 miles long, and two round trips a day would constitute a reasonable run, but the daily movement does not now amount to, nor is it expected to ever exceed, 120 tons, and this is handled in one round trip.

Leaving out for the present, questions of relative engine efficiency and terminal expenses, and assuming, as a necessary condition, that the road is to be operated independently of any other, it is obvious that, under the circumstances, there is no possible way of effecting any reduction in cost of conducting transportation; and it follows that all that can legitimately be saved in cost of construction and equipment is just so much clear gain.

The proposition may be stated generally thus: With a minimum traffic, net-earnings per ton-mile are least and fixed charges, per ton-mile, greatest; if the traffic increases, the net earnings per ton-mile, under favorable circumstances, also increase within limits, while at the same time the fixed charges per ton-mile decrease in inverse proportion to tonnage. The difference between the two at any stage constitutes the profit or loss, as the case may be, of direct operation; if the cost of movement in a given case is already as low as it possibly can be at a certain volume and if there is no way of increasing the volume, the fixed charges must be kept at the minimum to secure greatest economy; whereas, on the other hand, with an increasing volume, any betterments which have the effect of maintaining the ratio of profit to fixed charge are justifiable, and betterments which would increase that ratio are obligatory, provided they can be recouped.

In the case before us we have the first condition exemplified and made more striking because of the limited duration of the business, requiring the refunding of the capital in 12 years. In the above propositions, of course, the term fixed charges cover such provision as well as all constant expenses of whatever nature, including capitalization of transfer and rehandling. It may be said that no railroad could exist under such severe conditions excepting with abnormally high transportation rates.

It might, of course, prove true that the capitalization of transfer expenses, and the extra cost and maintenance of a separate narrow gauge equipment would offset the saving in construction account due to the narrow-gauge; in that case the cogent reason would vanish and there would be no justification for departing from the standard gauge; while on the other hand it is plain that the reason might continue to exist with a larger volume of traffic, up to a certain point.

But we will pass on to the dear old, exploded, narrow gauge fallacies that even among the rocky knobs and sterile sands of the Black Hills seem to have taken new root; for we find that among the reasons set forth in the paper for adopting that gage are enumerated the lighter rail (40 lbs. and 45 lbs.); lighter trestle bridges, and lower cost of track maintenance. All of these are independent of the gage, and determined by the weight and concentration of engine employed; in this case a 56-ton Mogul, compound, with 60,000 lbs. on drivers, and weighing, of course, practically the same as an equal-powered engine of standard gage.

Viewed from the point of economical wear, the wisdom of adopting such a light rail as 45 lbs. for 3 per cent. grades and curves up to 45 deg., guard rails being introduced on all curves of 30 deg. or over, is to be questioned; although its use seems to have greatly

facilitated track-laying. Taking into further consideration the extremely limited service and tonnage, the light rail may prove satisfactory, an interesting point to inquire into after a year or two more of trial.

Common experience does not support the view taken in the paper that a light rail reduces maintenance expenses, but just the reverse; while excessive curvature adds both to the cost of maintenance and to the proportion of wasteful and injurious rail-wear.

The trestles, excepting that the caps and sills are two feet shorter, have dimensions adequate for standard gage structures.

The saving in excavation due to the gage is also adduced; yet it is to be noted that the adopted width of roadbed, 12 ft., at grade in cuts and tops of banks, is used on many standard gage lines; and, further, it was found that "it cost more to handle carts in the narrow cuts."

The argument relating to the non-use of foreign cars for the reasons given has no direct bearing on the gage. It would apply with equal force to a separate standard gage equipment, if used exclusively on the home line. And in most cases the use of foreign cars without the expense, delay and inconvenience of transfer would undoubtedly be resorted to.

The claim made on account of the sharper curvature of the narrow-gage location as a means of avoiding excessive excavation, and saving in length and height of trestles is legitimate in itself, although here, as in every similar case, there are accompanying disadvantages, and even in this case more than half the entire length of curved line is well within the limit of curvature successfully operated elsewhere by ordinary main-line engines of standard gage, and therefore not affected.

The cost and inconvenience of transferring and re-handling, owing to the break of gage is stated to be relatively unimportant in this case; but in general this would not be so, as dear experience has abundantly established, and often it would prove a determining factor. As to what the actual cost of a standard gage road between the same termini would have been we are not informed. We are told that no careful location was made to determine that question, but that sufficient data were obtained to show that the road-bed, bridges and track material would have cost 80 per cent. more, "which would add an interest charge of 20 cents per ton." In view of what has already been stated, it is difficult to account for such a great difference, except on the supposition that the proposed standard gage limitations were not up to the extremes of modern practice, and that the use of some long-wheel base type of ordinary road-engine was in view.

It would have been important before deciding the gage question to see what results could have been obtained with standard gage operated with geared or "stem-winder" engines, such as are in successful use on high-grade roads, which have but 56 in. rigid wheel-bases and work economically on 6 per cent. grades and even higher. With this additional latitude it would appear as if a marked saving in distance, curvature and cost could have been effected. On the whole, it may fairly be said that while the United Verde & Pacific Railway appears to be a creditable piece of difficult and skillful construction, the adoption of the narrow gage was not a safe precedent to follow even under analogous extreme conditions.

The Permissible Strain on Draft Rigging.

A correspondent sends us a hard question, one in the nature of things impossible to answer precisely; but one of actual, live, human interest. Therefore we will take it as a text and perhaps some heads of mechanical departments will find the application of the sermon. If but one of the multitude feels convicted of sin, we shall be more than satisfied.

"What is the permissible working strain on the draft rigging of modern freight cars with automatic couplers."

"I ask this with the view of determining the train-load on the lighter grades where the strength of the draft rigging is practically the controlling factor."

The pull on the draft rigging of freight cars is of two kinds: the steady pull due to the resistance of the train, and the sudden pull due to the jerks of the engine and the jerks caused by short variations in grade. The best automatic, vertical plane couplers now built will stand a steady pull of at least 100,000 pounds, but most of those in service will not stand more than 75,000 pounds.

A good modern draft rigging, with a strap end on the coupler, will stand fully 100,000 pounds, but the tail bolt end will not stand as much, and as there are many in service of both kinds that are not safe above 50,000 pounds steady pull, it is not best to allow, as a safe pull on a train of miscellaneous cars, more than 50,000 pounds when the pull is steady.

If one knows the cars in the train and is pretty sure

that the draft riggings are strong and of the strap form, it is safe to allow as much as 70,000 pounds for a steady pull, as the limit of strength will then be in the couplers. If the draft rigging and the couplers are of the best modern makes, and comparatively new, as much as 100,000 pounds may be allowed.

These figures do not, however, fix the limit of the load, as the sudden jerks are generally the cause of the parting of the trains. It is seldom that a steady pull causes a break-in-two, and when such is the case there is always a weak and defective part at the point of breakage. The limit of steady pull of a locomotive is only about 600 lbs. for each ton on drivers. This is the limit, and, generally, the maximum is not more than 500 lbs. per ton. A large consolidation will weigh about 60 tons on drivers, so that the limit of the steady pull is not more than 36,000 lbs., and any draft rigging that will break with this pull is unfit for service; and the same may be said of the coupler.

The effect of a jerk is quite another matter, and is of course very difficult to calculate. We do know that the jerk of a locomotive can break draft gears and couplers that will stand 120,000 lbs. under a steady pull. This is a very severe jerk, and the average is much less. There can seldom be any reason for handling trains so roughly that the jerks exceed the strength of a draft gear and coupler that will stand 90,000 lbs. under a steady pull; but engineers are careless and rough beyond reason in handling trains, and in this is found the limit of loading under the conditions that our correspondent gives.

A more specific and direct reply to our correspondent's question is that the limit of loading will depend first, upon the care of the engineer in handling the locomotive, especially if the train is a double-header; and, second, upon the draft rigging and coupler design. Common mixed trains with miscellaneous cars are uncertain things, and while a steady pull of 100,000 lbs. might not break one train, the next following might be broken with a pull of 30,000 lbs. So that all that can be said, about the limit of pull that is of use to an operating officer, is, that good couplers and draft riggings will stand the combined pull of two large consolidation locomotives with a reasonable allowance for jerks; but no such pull can be used in service unless the engineers are careful and are made to understand that they will be held responsible for all parting of trains when the broken parts of the connections are not found to be defective.

The Master Car Builders' Association has been long considering the question of the proper limit of strength of couplers and draft gears, but so far no limit has been reached that has been accepted by many of the roads. There are no standards for the strength of couplers and draft gears, but the standard proposed in 1892 for couplers called for a steady pull of 100,000 lbs. This was not put to vote and was not adopted. Since then, last year, a jerk test has been recommended as a means of examination, but it has not been defined as to limits, so that to-day there are no adopted or proposed standards of strength for either the M. C. B. coupler or for the draft gears in common use.

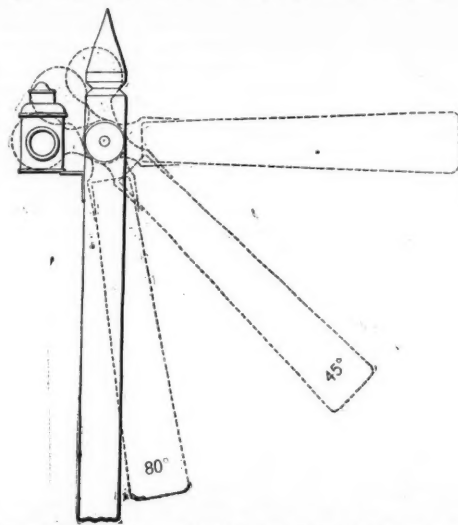
This is an important subject to operating officers who so well appreciate that the limit to the weight of trains is often found in the draft gears and couplers. It will surprise some operating officers, no doubt, to know that the M. C. B. Association has no limit of weakness for such important details of cars as the draw-bars and draft gears which affect so greatly the safe handling of trains, but such is the fact. The reason for the failure to fix upon a standard is found in the difficulty of reaching a conclusion in the face of conflicting opinions. The tests of couplers that have already been made have settled the maximum practical strength that may be properly be asked from those who build couplers, and the strength of draft gears can easily be made greater, so that if all were of the same mind in the matter of the usefulness and desirability of fixing upon a standard limit of weakness, or of strength, it could be done at once. But all are not of one mind, for many have been so occupied with the need of a reduction of the breakages of couplers by blows in switching, and have been so impressed by the many guarantees for the reduction of the cost of repairs, that the indirect cost of delays and wrecks caused by breakages, and the increased cost of being compelled to run short trains to reduce the breaking-in-two of trains, have not been seen in their full significance.

Such inquiries as that of our correspondent bring into clear light the bearing that weak couplers and draft gears have on the cost of operating trains, and those who know that couplers and draft gears are now being put into service without tests, and so weak as to be unable to stand a steady pull of 50,000 lbs., will appreciate the unfortunate situation of those roads on which the train weights are limited to the safe strength of couplers and draft gears. The situation is

this: Such roads might reduce operating costs by handling heavier trains, but cannot do so because they are compelled to accept cars in interchange traffic with weak couplers and draft gears, of which there are many in service, and more going into service daily, and for which there is no M. C. B. standard, and generally no proper inspection.

The new proposed alterations in the "Rules of Interchange" will, if adopted, show up this situation in its true light. Under the proposed change, owners of cars will have to pay foreign roads for breakages not caused by wrecks, and when the bills for replacing defective and weak material begin to pile up, as they will in some cases, then will the value of the standards of strength of parts of cars become more apparent, and after a few years it may be that our correspondent can quickly select the weak cars from the strong ones, and putting the weak ones at the rear of the train, may take for a load as much as a locomotive can pull, but until then he must rely on his ability to make a shrewd guess and pay the damages if he is a bad prophet.

The distant signal is a vital factor in train-running, if high speed is to be maintained, and the increasing demand for fast trains (or rather the meeting of this demand) has finally led to such an appreciation of this fact that distant signals—more or less perfectly adapted to their purpose—are being erected much more generally than was the case a few years ago. This increased activity has led to renewed efforts to overcome the chief difficulty in operating mechanical signals at a distance, the variation in the length of the wires; and in recent issues we have described a number of mechanical devices designed to accomplish this object; Johnson's, Mitchell & Stevens' and the Lynam-Adams automatic compensators, Annett's adjuster, and a new "manipulator" made by a new company. But one of the most interesting devices for avoiding difficulty on account of expansion and contraction of wires cannot be illustrated by a drawing; it is found on the New York Central. Mr. McCoy, Superintendent, and Mr. Kinch, Supervisor of Signals, on



Connections must be so adjusted that when the lever is reversed the arm will stand not less than 45° nor more than 80° from the horizontal.

the Hudson division of that road inform us that they operate distant signals successfully, summer and winter, more than half a mile from the tower, without any compensator at all. Their "device", they say, is simply good apparatus and good discipline. All inspectors are required to keep the adjustment within the limits necessary to enable the operator always to pull the signal arm down to at least 45 degs. from the horizontal and never more than 80 degs. (see diagram). A good quality of steel wire is used, No. 9. This does not stretch as does common iron wire, and this fact alone accounts for a good part of the improvement as compared with ordinary practice. All bearings are kept well oiled, the pulleys in the carriers attached to the stakes supporting the wires being oiled about once a week. Black oil is used in summer. Eight-inch wheels (and chains) are used at all sharp angles. With these requirements carried out, it is not found necessary to adjust the wire except once in the spring and once in the fall. The number of distant and starting signals located 2,600 ft. or more from the tower is considerable, and there are a few located over 3,000 ft. from the tower, all of which are worked without compensators.

The Supreme Court of North Carolina has sustained the state Railroad Commissioners in their decision, is sued last November, compelling the Western Union Telegraph Company to transmit a message from Wilson to Edenton for 25 cents, in accordance with the tariff established by the commissioners, notwithstanding the fact that the message was sent over a wire running through a part of Virginia. It appears that the Western Union has a wire running through Edenton, but, so far as that station is concerned, devotes it exclusively to railroad business; and that this message was delivered at Norfolk to another telegraph company to be transmitted the rest of the way. The defense was that the railroad

business fully occupied the Western Union wire, and that there was not enough commercial business to pay for putting up an additional wire; and for this reason the Western Union decided to give the other company the commercial business. It appeared that at other stations on the same line the Western Union did commercial business. Something was said in the testimony about the fact that the Western Union office was at the railroad station, while to do commercial business it would be necessary to establish an office "up town"; but this point seems to have received little or no attention from the judge. The court holds that it is the duty of the company to have sufficient facilities to transact all business offered, for all points at which it has offices. Giving the railroad company a preference is an illegal discrimination against other customers. Although the operator was the station agent, a clause in the contract between the Western Union and the road made him the agent of the telegraph company. Even if the discrimination were not illegal, the small cost of an additional wire, which, "it is common knowledge, does not exceed \$10 a mile," imposes the obligation to furnish facilities to do the business of all. The distance from Wilson to Edenton in an air line is about 75 miles, but by the nearest rail route is about three times that.

The legislature of New Hampshire, which has recently adjourned, passed no general laws affecting railroads, except one, a long one of 24 sections, providing for the incorporation and regulation of street railroads. This law is drawn in stringent terms, though it gives large powers to town officers. They are to determine the question of public exigency and to approve the route, but an appeal may be taken to the railroad commissioners, except in the matter of the location of tracks, poles, etc., on which the town officers have exclusive and final jurisdiction. The town officers may prescribe quality and kind of material and rates of speed, but regulations thus made may be appealed to the railroad commissioners, whose decision will be final. Grade crossings with standard railroads are permitted, on consent, in writing, of the railroad commissioners, but street cars must be stopped before crossing. Section 20 provides that if a foreign corporation, which owns or controls a majority of the capital stock of a domestic street railway, shall hereafter issue stock, bonds, or other evidences of indebtedness based upon or secured by the property, franchises, or stock of such domestic corporation, unless such issue is authorized by the law of New Hampshire, the Supreme Court, sitting in equity, shall, upon petition of any party interested, dissolve such domestic corporation. The last two sections authorize existing steam railroads to change their motive power to electricity and authorize an increase of stock for this purpose on approval of the railroad commissioners.

"Out West" the states find various ways to make their railroad commissioners useful, which are never thought of in the effete East. The latest function thrust upon such a body is the inspection of watermelons. The Legislature of Missouri, finding that the raisers of these traffic disturbers in the southeastern part of that state were injuring their own interests, in their zeal to compete with Georgia shippers in reaching the northern markets early in the season, has directed the State Railroad Commissioners to appoint an inspector for each county from which melons are shipped. One of the commissioners, speaking to a St. Louis reporter, says:

The law was necessary for the preservation of the industry. Last season was backward for the Missouri watermelon growers. In their haste to head off the Georgia melon and get first to the markets, unscrupulous growers plucked green melons and flooded the markets with them. The result was that the Missouri melon was brought into disrepute. Honest growers suffered because of the impositions practiced by dishonest growers. Five counties in this state shipped thousands of car loads of watermelons. One county alone—Scott—sent \$200,000 worth of melons to the world's markets. The total output reached nearly \$1,000,000. In Scott, Mississippi and Dunkin counties watermelon growing is a leading industry.

Now, if these inspectors will devise a way to keep farmers who can not pay the freight on a car load from shipping melons to commission merchants who will not pay it, they will receive the thanks of the general freight agents.

The spring floods were very heavy both in New England and in the Middle States, many accounts reporting the water higher than before for 30 or 40 years; but damage to railroad property has been reported in only a few instances. Highway bridges were carried away in the vicinity of Brattleboro, Vt. Near Barre, Vt., a trestle of the Central Vermont was carried away. There were numerous washouts on minor roads in Vermont, and the track of the Concord & Montreal was overflowed in a number of places. The Delaware River at Trenton, N. J., and for many miles above and below, was very high. Trains on the Amboy division of the Pennsylvania had to be suspended between Trenton and Bordentown for a day or two, and the water rose to within 3 ft. of the main line bridge at Trenton. Near Bordentown, a passenger train was derailed in deep water, and the passengers had to be taken off on a raft. The Delaware & Hudson Canal was much damaged between Eddyville and Honesdale. At Susquehanna, Pa., part of the iron bridge leading to Oakland was washed away. The Pennsylvania Railroad had some very bad landslides at two or three points near Harrisburgh. There was a severe storm of wind and snow in Kansas and Colorado on

April 5, 6 and 7, and many passenger trains were snow-bound. Much sand was mingled with the snow in the drifts, and Denver despatches reported banks 70 miles east of that city which were 30 to 40 ft. deep. The east and west lines between Kansas City and Denver were blockaded for three or four days, except that the Burlington seems to have had much less snow than the others. A great many cattle were driven against the fences and perished.

An hour or two after we went to press last week the anthracite situation was completely changed by the sudden and unexpected stand taken by the Reading Company in a demand for 21 per cent. of the tonnage. Up to that time it was understood that, while the Reading had not agreed to arbitrate its differences, the chances of agreement were good. In 1894 the Reading hauled between 20.2 and 20.3 per cent. of the total anthracite tonnage. Its demand of 21 per cent., or an increase of about one-third of a million tons, caused all negotiations to be declared off. An attempt was made to secure a conference with the Reading receivers in New York on Monday. They agreed to attend, but at the last moment sent notice of inability to do so. The situation as regards an adjustment of differences is unchanged. It is generally believed that another attempt will be made this week or next to adjust matters. The most encouraging sign is the disposition of all interests to enforce restriction to 50 per cent. of their capacity. This is offset in a measure by a dead market. There is no demand, and dealers who contracted at the old or lowest prices of the season are delaying deliveries with the idea that prices may go lower.

NEW PUBLICATIONS.

Engineering Education.—Proceedings of the second annual meeting of the Society for the Promotion of Engineering Education, held in Brooklyn, August, 1894. Edited by George F. Swain, Ira O. Baker and J. B. Johnson. Price \$2.50. Address Prof. J. B. Johnson, Washington University, St. Louis, Mo.

The Society for the Promotion of Engineering Education was organized in Chicago, August, 1893, and grew out of the interest felt in the work of Section E of the Engineering Congress. The work of that first meeting appeared in Volume I, which was published last year; Volume II gives the proceedings of the second meeting of the Society and the papers presented at that meeting. The proceedings form but a small part of the volume of 392 pages, and the papers are so many that we shall not attempt to even give their titles. They cover requirements for admission to the engineering courses, the matter of engineering degrees and methods of teaching various subjects, and this latter division of the contents must be construed very broadly, for the papers range over a great field.

Journal of the New England Water Works Association. March, 1895. Quarterly; 75 cents a number. Walter H. Richards, Junior Editor, New London, Conn.

The March issue of this quarterly contains the proceedings of the quarterly meeting held in Boston last December. Forty-four pages of the pamphlet are taken up by papers by Mr. G. F. Chase, Mr. Dexter Brackett, Mr. E. D. Leavitt and Mr. W. F. Codd, with discussions thereon.

TRADE CATALOGUES.

Hunting and Fishing Along the Northwestern Line.—A book descriptive of the hunting and fishing resorts along the Chicago & Northwestern Railroad. Edited by W. B. Leffingwell and illustrated by W. L. Wells. 84 pages, 6 x 8 in. Issued by the Passenger Department, Chicago & Northwestern Railroad, 1895. This book gives a description of 90 resorts along the Chicago & Northwestern Railroad, telling of the kind of game found at each place, the hotel accommodations and means of access. The game laws of Illinois, Wisconsin, Michigan, Minnesota, Iowa, Nebraska and South Dakota are given, and also a map of Northern Wisconsin and Michigan showing the lakes, streams, roads and trails.

Power Transmission Machinery.—The Link Belt Machinery Co., of Chicago, sends us catalogue No. 19, being a pamphlet of 56 pages, giving many interesting illustrations and particulars of the well-known machinery and parts manufactured by that concern. The illustrations are mostly half tones from photographs, and many of them are interesting.

TECHNICAL.

Manufacturing and Business.

The Badger Construction Co. has been organized at La Crosse, Wis., by F. P. Hixon, J. M. Hixon and George H. Gordon, of La Crosse. The capital is \$250,000. The company is to carry on general contract business, including construction of railroads and canals. The company now has a project on foot of constructing a railroad from Prentice to Antigo, Wis., a distance of 70 miles.

The adjourned annual meeting of the Union Switch & Signal Co. was held in the Westinghouse building at Pittsburgh on April 9. The following officers and board of directors were elected unanimously: President, George Westinghouse, Jr.; Vice-President, E. H. Goodman; Board, George Westinghouse, Jr., A. M. Byers, Thomas Rodd, James H. Willock, William McConway.

The Ensign Manufacturing Co. has received an order from the Michigan Central Railroad Co. for one No. 2

single track Russell wing-elevator snow plow, to be delivered next November.

Albert O. Beebe, Eugene R. Leland, and Edward R. Thomas, of New York, and Samuel Shoebridge and Robert L. Lawrence, of Jersey City, have organized a contracting company in New Jersey, with a capital of \$500,000, to build railroads, canals, and do general contracting work.

It's probable that the preliminary arrangements now in progress will result in the establishment of steel works at Birmingham, Ala. The Jefferson Steel Co., owners of the old Henderson steel plant, have been negotiating with the Birmingham Rolling Mill Co. and the Sloss Iron & Steel Co. to this end. The rolling mill company will probably acquire the Henderson steel plant; melted iron will be furnished from the North Birmingham furnace of the Sloss Iron & Steel Co., a few hundred yards distant, and the hot iron will be made into steel at this plant, the output being used by the rolling mill company.

The Pennsylvania Bolt & Nut Co., Lebanon, will soon begin the manufacture of railroad spikes.

The Ramapo Wheel and Foundry Company has moved its New York office from 115 Broadway to Havemeyer Building in Cortlandt street.

The Dominion Government is calling for tenders to be received up to April 30 by the Secretary of the Railways Department, Ottawa, for the supply of 25,000 barrels of Portland cement.

The Northwestern Car & Machine Shops, at Oshkosh, Wis., were sold on April 14, by order of court, to satisfy the claim of creditors. Howard Jenkins, of Oshkosh, was the highest bidder, at \$22,000. The Niles Tool Works, which has a suit against the concern of \$22,500, was also an active bidder. These shops were built two years ago and represent an investment of \$150,000. Six cars were built and a receiver was appointed.

The Wiseman Automatic Safety Railroad Switch Co., of Chicago, has been organized by Theodore Wiseman, Thomas H. Kelley and Albert L. Coe.

The Campbell & House Combination Freight Humane Stock Car Co., of Baltimore, has been organized by the election of the following directors: Edwin Warfield, John K. Shaw, Seymour Mandelbaum, Howard Carlton and R. B. Campbell. The officers elected are: Edwin Warfield, President; R. B. Campbell, Vice-President, and Frank M. Hildebrandt, Secretary and Treasurer. The capital stock of the company is \$500,000.

The directors of the Hamilton Bridge Co., now being organized as the successor of the old Hamilton Bridge Works, will include William Hendrie, J. S. Hendrie, J. H. Tilden, C. S. Murray. The Chief Engineer will be Mr. J. W. Schaub, who was lately Chief Engineer and Manager of the Detroit Bridge Works.

The plant of the Akron Steam Forge Company in Akron, O., was destroyed by fire last week. The factory has been closed for over a year. Much valuable machinery in the building was ruined.

The Cole Furnace at Sheffield, Ala., has passed into the hands of Pennsylvania capitalists and will be known as the Sheffield Coal, Iron & Steel Co. The iron and steel department will be located in Sheffield, and the coal and coke department in Jasper, Tenn. The property will be put in complete operation at once.

Recent improvements made in the machine shop of Mackintosh, Hemphill & Co. embrace a 15-ton electric traveling crane, equipped with the latest electric appliances. Its span is 49 ft. and it weighs about 72,000 lbs. The Morgan Engineering Company, of Alliance, O., were the builders.

The Walker Manufacturing Company has secured the contract for the large dynamo to be placed in the power house of the Union Depot Railway Company, St. Louis. This dynamo will be a 12-pole machine of 1,500 kw. capacity and will weigh 180,000 lbs. The armature alone will weigh 95,000 lbs.

The works of the Crocker-Wheeler Electric Company, at Ampere, near Orange, N. J., were destroyed by fire last week. The main machine shop, the electrical building, and the boiler house were burned. The company will secure temporary quarters as soon as possible in order that orders now on hand may be filled, and the plant will be rebuilt as soon as the insurance is adjusted.

The Fulton Truck & Foundry Co., of Mansfield, Ohio, has received a large order for wheels, truck, etc., and electric supplies in general, for street car service. The order comes from Vancouver, B. C.

Iron and Steel.

Jones & Laughlins, who operate the American Iron and Steel Works, at Pittsburgh, will soon add to the plant by erecting four 40-ton open-hearth furnaces.

The Carnegie Steel Co. has about completed some extensive improvements in the 10-in. mill of the Homestead Steel Works, which have been closed for three weeks. New furnaces have been built and new rolls put in, which will increase the output without increasing the number of employees.

New Stations and Shops.

The Campbell-Zell Co., Baltimore, Md., has completed the plans for erecting new shops on the site recently purchased at Fell and Wolfe streets. The plans contemplate a building 265 ft. x 40 ft., a power house 40 ft. x 40 ft. The machine shops will be equipped with new ma-

chinery throughout. The boiler shop will be 80 ft. x 200 ft. This will be fitted with a traveling crane and a lot of new machines for shaping the heavy iron plates for the manufacture of boilers.

The roundhouses and machine shops of the Atlantic & Pacific Railroad at Winslow, Ariz., were burned on April 8, and eight locomotives were seriously damaged, the total loss being given as \$100,000.

The Grand Trunk Railway will build a new freight and passenger station at St. Henri, near Montreal.

Plans are ready for the new Canada Atlantic station at Valleyfield, Que., and work will be commenced as soon as possible.

Bids were opened April 12 for the construction of buildings for the branch works of the Griffin Wheel foundry in Denver. It is expected that the plant will be in operation by November. The Denver plant will have a capacity of 200 wheels a day, and will give employment to 150 men. The plans show three buildings, a main structure 309 ft. x 104 ft., a machine shop 80 ft. x 75 ft., and a core house 60 ft. x 40 ft. The plant will be run on a gravity system, but will have a 200 H. P. engine and a heavy battery of boilers. Mr. J. K. Choate has charge of operations in Denver.

The plans for the new car shops to be erected at Ottawa, Ont., by the Canada Atlantic, and Ottawa, Arnprior & Parry Sound railroads, have been completed. The main shop is to be 300 ft. long and 70 ft. wide, with a clear height above the tracks of 20 ft. The two companies intend manufacturing 100 cars for their own use this summer. These cars have hitherto been principally made at the Cobourg car shops.

Interlocking.

The Auto-Pneumatic Railway Signal Co., of Rochester, N. Y., has just completed an interlocking plant at the crossing of the Delaware, Lackawanna & Western and the Western New York and Pennsylvania Railroads at Mount Morris, N. Y. With this apparatus, which was described in the *Railroad Gazette* of Dec. 23, 1893, the signals and the derailling switches are operated by compressed air, and the interlocking is in the arrangement of the passages in the valves (in the tower) by which the signalman admits air to the different pipes.

The City Avenue Bridge Over the Schuylkill.

We abstract the following from a description of the bridge, by J. Vaughan Merrick, in the *Journal of the Franklin Institute*, for April, 1895:

This bridge, completed Oct. 1, 1890, had long been desired as means of communication between the two sides of the river at City Avenue, Philadelphia. This is the only means of crossing for a distance of two miles along the river between the Manayunk toll bridge and the Falls bridge. After careful surveys, a five-span bridge with a plank floor was adopted. The total length is 706 ft., comprising two end spans of 114 ft. each, and three channel spans of 170 ft. 6 in., 153 ft. 9 in., and 150 ft. 9 in. respectively. The width of the roadway is 30 ft., making with two 6-ft. sidewalks a total width of 42 ft. The channel spans are iron Pratt trusses with the roadway on the upper chord. The strength of the superstructure equals that usually required for railroad bridges. At the western end the roadway is 7 3/4 ft. above mean low water. For the calculations, 80 lbs. per square foot of roadway and sidewalks was taken in addition to weight of structure. A working stress of 12,000 lbs. per sq. in. was allowed for the eye-bars, 9,000 for the counter rods and 15,000 for the laterals; working stresses in the compression web members in the three middle panels 5,000 lbs. per sq. in.; maximum fiber stress in pins, 15,000 lbs. per sq. in. The total cost of the entire work was \$109,807.42. It earned from the beginning 4 per cent. on its cost after paying all expenses. This percentage has since largely increased.

Chicago Drainage Canal.

The regular meeting of the Drainage Board took place April 3 with Mr. Frank Wenter in the chair. Chief Engineer Mr. Isham Randolph in his report gave an explanation for omitting to deduct a certain sum from the payment of the contractors having the work on Sections 2, 3 and 4, as provided for in the terms of Clause J. This matter had been the subject of much discussion at the previous meeting.

The pay roll for the month of March, providing for the reimbursement of \$22,863, was ordered to be paid, and the report of the Treasurer was as follows:

Cash on hand March 1	\$1,565,784
Received from town collectors	108,712
Received from banks (interest)	7,465
Total	\$1,711,962
<i>Disbursements.</i>	
Construction department	\$368,703
Miscellaneous departments	24,917
Total	\$393,620
Total balance on hand	\$1,518,442

Car-Heating Suits.

The United States Circuit Court at Cincinnati has reversed the opinion of Judge Swan of the District Court in one of the suits for infringement of patents brought by the Consolidated Car Heating Co., of Albany, N. Y., against the Martin Anti-fire Car Heating Co., of Dun kirk, N. Y.

Car Window Shade Patents.

The E. T. Burrowes Co. has issued a notice, warning the public against using shades for car windows actuated by a spring, and having two handles opposed to each other at the lower edge of the shade, by pressing which together, movement of the shade is secured. The

statement is in brief, that a certain Mr. Piper, for a time a clerk in the office of the Burrowes Co., received, by an error at the patent office, patent rights for an invention really belonging to Mr. Burrowes. As a result Mr. Burrowes brought an interference suit, during which it was decided that he was the original inventor, and the patent was re-issued to him on March 19, 1895. The company deems it necessary in justice to itself to warn all those using curtains and shades having thereon this device, that they will be held responsible for such use.

Gas Engines on Tramcars.

In comparing the results of the gas tramcars and those using electricity in Dessau and other German cities, it is interesting to note that the gas tramcar has had somewhat the best of it. In snow 7 1/2 ft. deep, they cut their way through quite easily, and ran regularly except on the first day when there was a stoppage of some hours, occasioned by ice in the grooves of the rails. They were even able to push snow plows before them in addition to carrying their own load. The electric cars, on the other hand, in Lubeck, Dresden and other places, were forced to stop running. In Dresden also the gas cars worked without interruption.

A Railroad Instruction Car.

The Seaboard Air Line has just equipped at its shops at Raleigh, N. C., an instruction car, under the supervision of W. J. Hartman, superintendent of air brakes for that road. The car is completely equipped with all the air brake appliances for an engine, tender, and twelve cars. Sectional models complete the equipment. Conductors, engineers, brakemen, baggage-masters, etc., are instructed, in classes of from six to nine each, lectures being delivered and practical demonstration given in the most thorough manner.

Accident on the Manchester Canal.

On April 10, the steamship "Harold" entered the Latchford lock of the Manchester ship canal and ran into the opposite gates at full speed, breaking and passing completely through them, after which she dropped into the water of the lower level, a fall of 16 ft., and was badly damaged. The gates, which are of massive construction, weigh 300 tons. One of them sank and the other was left hanging across the lock. The upper gates were quickly closed, and fastened together with hawsers, thus preventing the disaster which the difference in level of the two sections of the canal made imminent.

THE SCRAP HEAP.

No.es.

The roundhouse of the Atlantic & Pacific at Winslow, Ariz., was burned on April 8, together with eight locomotives.

The American Express Co. has ordered its agents to refuse lottery business, and persons offering packages suspected of containing such matter must be made to open them.

Seven of the employees of the Great Northern, who obstructed mail trains in Minnesota at the time of the strike last summer, have been fined \$100. The court gives them time to pay the fines in installments.

The eastern car accountants who went to the San Francisco convention traveled by special train and stopped at Denver and other points of interest to see the sights. There were 130 persons in the party, including many ladies.

The four ticket forgers arrested at St. Joseph, Mo., several months ago, were tried last week and got off very easily, owing, it is said, to the influence of wealthy friends. One man was imprisoned for six months, one for three months, and one for 10 days; and one went free.

The Brooklyn Heights Railroad Co., one of the two principal street car lines in Brooklyn, has adopted some of the rules for safety recommended by the State Railroad Commission in its last two annual reports. The most important rule adopted is that cars shall stop at transverse streets before crossing them instead of after, and with the front platform opposite the cross walk; and that cars meeting at such crossings must stop or slacken speed so that passengers getting off of either car can have a good chance to see the other before stepping in front of it. Low speed limits are also prescribed.

Two more of the Dover (I. T.) train robbers have been killed by the United States marshals. George Spears, a Pullman porter, was instantly killed on a Rock Island passenger train at Allerton, Ia., on April 11, by a negro tramp. The porter, the conductor of the Pullman car and another trainman attempted to eject the tramp, when the fellow drew a revolver and shot, killing Spears instantly. He then jumped from the train and escaped in the darkness. Oliver Perry, the lunatic who made a sensation by trying to rob express cars and by running away with an engine on the New York Central, near Syracuse, Feb. 21, 1892, escaped from the State Insane Asylum, at Matteawan, on April 10, but was caught at Weehawken, N. J., on the 16th.

One of the objects of the promoters of the anti-pass provision in the New York State Constitution was to keep the members of the legislature from doing two things; first, from going home every Friday night, and second, from going to New York City as often as they pleased. According to the *New York Times*, the first of these objects has been in a measure accomplished, but the other one is evaded by the simplest device imaginable. Every member gets himself appointed on a committee and that committee, traveling at the expense of the

State, finds many matters in New York City that need investigation. No less than seven committees of this kind have thus far been appointed, and, according to the *Times*, they have a great deal of public business in New York on Saturday, Sunday and Monday.

Boston's Commerce.

The ninth annual report of the Boston Chambers of Commerce says: "The port of Boston continues to rank second only to New York in the value of her foreign commerce. Our exports of merchandise during 1894 amounted to \$84,656,636, our imports to \$53,398,848. While it is useless to deny that a portion of the traffic formerly handled at Boston has been diverted to the larger port, as was inevitable in some cases, an examination of the records discloses the fact that New York has not during the last ten years increased her commerce in the same ratio with Boston."

New Pennsylvania Ferryboat.

The Jackson & Sharpe Co., of Wilmington, Del., has contracted to build an annex ferryboat for the Pennsylvania Railroad Company for service between Jersey City and Brooklyn.

Wind and Weather Permitting.

The Silverton Railroad, 20 miles of very crooked line from Silverton to Ironton, Col., has been closed by the snow nearly all winter, but it will be dug out and traffic resumed sometime this month. Two locomotives for the line have been rebuilt at the Denver & Rio Grande shops in Denver, and are now ready to send out as soon as the road is open.

Geodetic Surveys in Russia.

Much important work has been done under the charge of the general staff of the Russian army in the completion of the geodetic surveys of that country. The work was begun at the instance of General Stebnitzki and has been, so far, carried along upon the lines of the principal Russian railroads. For several years this work has been going on, and had so far advanced last year that it was possible to bring together and compare the results obtained, and to issue a catalogue containing a list of about 1,000 stations for which levels had been secured. The lines run aggregate about 13,000 kilometers. One peculiarity of the results obtained is that no level so far determined is greater than 1,108 ft. above the sea. The fact that the figures vary between 361 and 492 ft. on the average shows how level the country is in Eastern and Southern Russia. Geographically considered, the work has been especially important, since it has established the practical identity of the level of the Baltic and Black Seas and the Sea of Azov.

The Columbus & Cincinnati Electric Railroad.

The projectors of the company which proposes building a line from Columbus to Cincinnati, a distance of about 120 miles, held a meeting this week and decided to push the work of construction this summer.

Lake Notes.

The Canadian Government has formulated relations for the new Sault canal under its ownership, and as a result there will be no tolls charged American vessels passing it. In consequence a large number of the larger craft of the American fleet will use the canal, and will be able to load to the full depth of the connection channels, which is now 17 ft. Thus these carriers will be enabled to load as deep from the head of Lake Superior as they do now from Lake Michigan ports. There will be a number of record-breaking cargoes the coming summer. It is not unlikely that cargoes of 5,000 tons, dead weight, will be carried through the canal this summer.

Contracts have been made by saw-mill men of Duluth for the towing of not less than 210,000,000 ft. of logs to their mills this summer. Besides these there will be a 100,000,000 that will be floated and hauled to the mills. It is estimated that there will be 300,000,000 ft. of lumber shipped east from Duluth the coming season, against 215,000,000 last year, 40,000,000 the year before, and not over 20,000,000 in any season previous.

The Chicago, St. Paul, Minneapolis & Omaha road will build at the head of Lake Superior another dock 200 x 2,500 ft., for the handling of flour and merchandise. The company now has docks at Duluth and Superior with a frontage of over 3,000 ft.

A bill has passed the Minnesota Legislature that fixes the taxation of vessels in the State at a uniform price of three cents per net ton, registered. This has already resulted in fixing Duluth as the port of call for several craft, and is expected to locate several large vessel companies at that place. It is stated that the taxation of the steamship Northwest, of the Northern line, would be not over \$65 a year under this bill. Some of the Milwaukee vessel companies are preparing to move to Duluth.

Early estimates, based largely on guesses for the expected wants of the opening season of navigation, give the Messaba iron range an output of about 3,000,000 to 3,200,000 tons of ore and the Vermilion 1,000,000 to 1,100,000 tons. Of this probable total of about 4,200,000 tons to be handled by three railroads, the Duluth & Iron Range will have 1,700,000 tons, the Duluth, Missaba & Northern 2,300,000, and the Duluth & Winnipeg 200,000 tons.

The Steel Canal Barge Co., which was incorporated recently in Cleveland, placed an order a short time ago with the Globe Iron Works Co., of Cleveland, for 6 boats, comprising a steamer and 5 consort each 98 ft. long, 17 ft. 9 in. beam and 10 ft. depth of hold. These boats will carry freight by water from Lake Erie ports to the east by way of the Erie Canal. On the day the contract was let for these boats a contract was made with the Johnson Co., to carry 10,000 tons of rails to New York.

R. P. I. Non-Resident Lectures.

Mr. Leffert L. Buck, of the class of 1868 of the Rensselaer Polytechnic Institute, delivered a lecture on Suspension Bridges before the students of that institution at Troy, on April 12.

Trent Valley Canal.

The Dominion government received 11 tenders for the construction of the Lakefield & Peterboro division, six miles in length, of the Trent Valley Canal, the tender of Brown, Lorne & Aymer, of Toronto, being the lowest. The work will cost in the vicinity of \$350,000, and the above mentioned firm will probably be awarded the contract.

Bar Iron Manufacturers Organize.

The bar iron manufacturers of Ohio, Illinois, Indiana and other States were again in session at Cleveland last week and completed their organization by the election of the following: President, W. E. Taylor, of the Union Iron Co., of Youngstown, O.; Vice President, Major Collins of the Central Iron & Steel Co., of Brazil, Ind.; Secretary, George W. Clarke, of the Mitchell-Trantor Co., of

Cincinnati, O.; Treasurer, James Corns, of Jas. Corns & Co., of Massillon, O.; Executive Committee: W. E. Taylor, Major Collins, George W. Clark, Scott Bonnel and Frank B. Felt.

Canadian Iron and Coal Output.

Statistics of the Canadian pig iron industry show that during 1894 the production was 53,014 tons. Of this 40,000 tons were produced in Nova Scotia. The coal output of the Nova Scotia mines was 2,168,340 tons. The government of Nova Scotia collected in 1894 royalties on mines and minerals amounting to \$242,657. The royalty on coal alone amounted to \$209,390.

The American Liner St. Louis.

The St. Louis, the first of the two twin screw 11,000-ton steamers built by the Messrs. Cramps at Philadelphia, will start on her first voyage from New York on the 5th of June and is timed to arrive at Southampton on the 12th. The vessel will return three days later and will thereafter take the place of the Berlin. The service will thus be conducted by the Paris, New York and St. Louis, and they will have three days only at each port.

The April Crop Report.

The April report of the Statistician of the Department of Agriculture makes the average condition of winter wheat on the 1st of April 81.4, as against 86.7 last year. It was 77.4 in 1893, 86.2 in 1892, and 86.9 for the year 1891. The average for rye is 87. The averages of wheat for the principal winter wheat states are as follows:

	1895.	1894.		1895.	1894.
Kentucky.....	85	83	Missouri.....	89	88
Ohio.....	86	91	Kansas.....	53	72
Michigan.....	67	83	Nebraska.....	45	85
Indiana.....	83	91	California.....	91	87
Illinois.....	87	92	New York.....	82	..

Generally the past winter has been hard on wheat. The fall of 1894 was a dry one and not favorable in many States either to germination or to the maintenance of the vitality of the plant. The spring has also been drouthy over extensive areas. Much good, however, has been produced by the rains in the latter part of March, particularly in the States of Indiana, Illinois, Missouri and Iowa. Moderate rains also fell in Nebraska and South Dakota. It is reported, however, that the soil was so dry and had suffered so long from drouth that it will require much heavier rains to produce any permanent effect.

A Gas-Motor Car for New York.

A street car, equipped with a Connelly gas motor, has been shipped to New York by the J. H. Vogan Car Manufacturing Co., of New Castle, Pa. It will be used upon the Second avenue surface line.

A New Liquid for Thermometers.

A new liquid, toluene, has recently been used in thermometer tubes, which while making a very sensitive thermometer, has an exceedingly low freezing point and retains its fluidity down to very low temperatures, without sticking to the sides of the tube.

Launch of the Steamship "St. Paul."

The American liner *St. Paul*, which stuck on the way on March 25 while being launched from the Cramps' ship yards, was successfully got into the water on April 10. All the congratulatory speeches which had been prepared for the first occasion were delivered at the luncheon which followed the launch.

Color Blindness.

A lady in Springfield, Mass., writing to a local paper, has made the somewhat remarkable discovery that, sometimes, color blindness is a good thing for a conductor to have. She refers, however, not to the inability to distinguish between red and green but to the good results of an urbane habit of not distinguishing between white and black passengers; and she refers to electric car conductors, whose behavior she has observed; not to the old fashioned kind. But as every conductor must now look forward to the possibility of ending his career on a trolley car, the item should be of interest to railroad men.

Extension of the Sceaux Railroad in Paris.

The Sceaux Railroad is just completing the new underground extension of its line under the Rue Denfert-Rochereau and the Boulevard St. Michel, which was briefly described in the *Railroad Gazette* of Oct. 12, 1894. When it is in service, passengers will be able to take their trains in one of the most thickly populated quarters of Paris instead of going to the old station in the southern end of the city.

In part the tunnel had to be run over the catacombs, through which immense pillars were sunk to give the necessary stability. The operations above ground were confined to one side of the boulevard only and thus traffic was very slightly interrupted. The terminal station at the Luxembourg Gardens is rapidly approaching completion. The tracks have already been laid in the tunnel and trains will probably be run in a few weeks. The interval between trains will be five minutes. The line, after running 1,800 meters, terminates at the Sceaux station which has been rebuilt and enlarged to accommodate the increased traffic that will result from the new line.

A further extension of the road is proposed to the Square Cluny, from whence it will describe a curve and join the Metropolitan along the Boulevard St. Germain, or the Moulinsaux line at the Place Maubert.

LOCOMOTIVE BUILDING.

The Rhode Island Locomotive Works has an order for a Forney engine for the Boston & Maine for its suburban service out of Boston.

The Duluth, Messabe & Northern Railroad has given an order for consolidation engines to the Pittsburgh Locomotive Works. The Norfolk & Western is also understood to have given an order for engines to the Pittsburgh Works.

The Baldwin Locomotive Works have received a number of small orders within the past few days, including engines for the Kansas City, Osceola & Southern Railroad of Missouri; ten-wheel engines for the Central Vermont, and six-wheel connected engine for the Union Terminal Road (belt line) at Kansas City.

CAR BUILDING.

A contract to rebuild 300 refrigerator cars for the Baltimore & Ohio Railroad has been given to the South Baltimore Car Works.

Rhodes & Curry, of Amherst, N. S., are completing an order for fish cars for the Dominion Atlantic Railway. These are to be box cars having passenger car trucks and

springs. They will be run with express trains and will be used in sending fish to the United States market from Nova Scotia.

BRIDGE BUILDING.

Aransas Pass, Tex.—The Youngstown Bridge Co., which has the contract for the 4,000 ft. double-tracked steel viaduct at Corp s Christi Bay, has begun the erection of the steel work for the Padre Island pier.

Brampton, Ont.—The Town Council have decided to build a new steel or iron bridge.

Chicago.—The South Park Board of Commissioners last week awarded contracts for the erection of a stone bridge over Fifty-ninth street in Jackson Park to Fitz Simons & Connell on a bid of \$39,000.

Chicopee, Mass.—The R. F. Hawkins Bridge Works, of Springfield, Mass., has been awarded the contract for the new highway bridge over the Chicopee River at the Falls, for \$26,745. The bridge, which is to be built by Aug. 1 next, is to be 400 ft. long, and will consist of four half-deck riveted lattice spans. The bridge is to have a 20-ft. roadway, with an 8-ft. sidewalk on one side and 10-ft. runway for electric cars on the other side.

Cockeysville, Ind.—The Baltimore County Commissioners will probably build a new iron bridge at Beaver Dam, near Cockeysville.

Denver, Colo.—The Youngstown Iron Works Company was awarded the contract to construct a wagon bridge for the city of Denver on Broadway. The bridge will be 100 ft. wide with a span 122 ft. It will be mainly of steel, and will cost \$45,000.

Deseronto, Ont.—It is proposed to build a traffic bridge over the Bay of Quinte, near Deseronto.

Fort Steele, B. C.—Mr. H. L. Cummings has been awarded the contract for the erection of an iron bridge across the Kootenay River at this place. Work is to be commenced at once.

Gettysburg, Pa.—The County Commissioners will open bids on May 1 for the erection of a high truss wrought iron bridge across Rock Creek at Lot's Ford, on line of Cumberland and Mountjoy townships. The span to be 100 ft.

Gladstone, Minn.—The contract for building an iron bridge over the Escanaba River, three miles west of Gladstone, has been let to the Gillett-Herzog Manufacturing Co., of Minneapolis, Minn., for \$5,700. The bridge will have a span of 227 ft., and is to be completed by Sept. 1. There were 10 bids on the work.

Grand Mere, Que.—All the pillars on the new railway bridge being constructed by the Great Northern here, over the St. Maurice River, are completed. The contract for the iron work has been awarded to the Dominion Bridge Company, Lachine, Que.

Hamilton, Ont.—The Dominion Government have now under consideration, several tenders for the construction of the Burlington Channel Bridge.

Indianapolis, Ind.—The Board of Works last week opened bids for the new bridge to be constructed over Pleasant run at Raymond street, and for the bridge across the canal at Pratt street. Contracts were not awarded. The bids for the Raymond street bridge were as follows: Rochester Bridge & Iron Co., \$3,374; Wrought Iron Bridge Co., \$3,150; New Columbus Bridge Co., \$3,150; Massillon Bridge Co., \$3,090; Indiana Bridge Co., \$2,800; Toledo Bridge Co., \$2,690; Youngstown Bridge Co., \$2,668; American Bridge Works, Chicago, \$2,631; J. D. Adams & Co., \$2,580. The bids for the Pratt street bridge were as follows: Youngstown Bridge Co., \$1,413; Indiana Bridge Co., \$1,415; J. D. Adams & Co., \$1,480; American Bridge Co., \$1,498; Massillon Bridge Co., \$1,525; Toledo Bridge Co., \$1,540; New Columbus Bridge Co., \$1,575; Wrought Iron Bridge Co., \$1,800; Rochester Bridge Co., \$1,828.

Liberty, Pa.—Viewers have been appointed to report on the erection of a new county bridge over Block House Creek in this borough.

Louisville, Ky.—Work upon the Louisville and Jeffersonville bridge is almost finished. The tracks have been laid over the structure and the viaduct approaches are completed, with the exception of a short addition to the Louisville approach, which will be built by the Louisville Bridge Co. The last two spans were erected in 60 days, a remarkably short time considering their great length (550 ft.).

Midway, B. C.—A new bridge is to be built. It will be known as the Ingram bridge.

Morrison, Pa.—High water carried away the structural work of the bridge in course of erection by the Massillon (O.) Bridge Co., over Kinzua Creek, at this point, entailing a loss of about \$500. The company will rebuild at once.

New Haven, Conn.—Secretary of War Lamont has informed the city authorities that he has decided that a drawbridge is necessary in place of the present structure over the Quinnipiac River on Grand avenue. The city must build the bridge before Dec. 31, 1896.

Ottawa, Ont.—The Ontario legislature have granted a bonus of \$50,000 towards the construction of the inter-provincial railroad bridge across the Ottawa River at Nepean Point. The grant is made subject to an expenditure of \$600,000 on the work and grants of at least \$100,000 by the Dominion Government and \$50,000 by the Province of Quebec.

The Department of Railways and Canals has awarded the contract for a new swing bridge at Wellington, over the Rideau Canal, to the Canada Bridge & Iron Co.

Pittsburgh, Pa.—County Engineer Davis has submitted his estimates for county bridges for the year 1895. The total is \$40,600, as follows: Thompson Run, \$2,800; Moon Run, \$3,000; Painter's Run, Scott township, \$2,600; Kilbuck Run, \$2,600; Lewis Run, \$2,100; Pine Creek, McCandless township, \$3,000; Chartiers Creek, Carnegie borough, \$12,500; Campbell's Run, \$3,000; Thompson's Run, \$3,200; McLaughlin's Run, \$3,300; Hurn's Run, \$2,500.

Rochester, N. Y.—A bill authorizing the construction of a bridge over the Erie Canal at Exchange street, Rochester, has recently passed the New York State Senate.

Thorah, Ont.—A new bridge is to be built over Connell's Creek, on the township line between this place and Eldon.

Waco County, Tex.—The Texas Legislature passed a bill authorizing Waco and McLennan County to jointly erect a bridge across the Brazos River.

Warren, Pa.—Bids are now being received for an iron bridge of two 220-ft. spans, over the river at this place. The width will be 30 ft., comprising an 18-ft. roadway and two 6-ft. sidewalks.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Maine, quarterly, \$1.50 per share, on the common stock, payable May 15.

Cincinnati, Sandusky & Cleveland, semi-annual, 3½ per cent. on the preferred stock, payable May 1.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Central of New Jersey, annual, Jersey City, May 10.

Chicago, Burlington & Quincy, annual, Chicago, Ill., May 8.

Delaware & Hudson Canal, annual, 21 Cortlandt street, New York city, May 14.

Eastern Railroad in New Hampshire, annual, Portsmouth, N. H., May 7.

Elmira & Lake Ontario, annual, Room 15, 20 Whitehall street, New York City, May 2.

Gulf & Interstate of Texas, annual, Tremont Hotel building, Galveston, Texas, May 9.

Lake Shore & Michigan Southern, annual, Cleveland, O., May 1.

Langhorne & Bristol, annual, Reading Terminal Station, Philadelphia, Pa., May 6.

Michigan Central, annual, Detroit, Mich., May 2.

Missouri, Kansas & Texas, annual, Parsons, Kan., May 15.

New York, Chicago & St. Louis, annual, Cleveland, O., May 1.

Norfolk & Western, annual, Roanoke, Va., May 1.

Union Pacific, annual, Boston, Mass., April 24.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *State Railroad Commissioners* will hold their seventh annual convention at the rooms of the Interstate Commerce Commission, Washington, D. C., beginning May 14.

The *Master Car Builders' Association* will hold its annual convention at Thousand Islands, Alexandria Bay, N. Y., commencing June 11.

The *Master Mechanics' Association* will hold its convention at the same place, commencing June 17. Applications for rooms for both conventions should be made to J. B. Wistar and Charles W. Crossman, both at Thousand Islands, Alexandria Bay, N. Y.

The *International Railway Congress* will meet at the Imperial Institute, London, England, beginning June 26.

The *American Society of Civil Engineers* will hold its annual convention at Nantasket Beach, commencing June 18.

The *Western Railway Club* meets in Chicago on the third Tuesday of each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the fourth Wednesday of January, March, April, September and October, at 10 a. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets on the first Wednesday in each month, at 8 p. m. The headquarters of the society are at 1736-1739 Monadnock Block, Chicago. The business meetings are held on the first Wednesday at its rooms. The meetings for the reading and discussion of papers are held on the third Wednesday at the Armour Institute, Thirty-third street and Armour avenue.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, 36 Bromfield street, Boston, on the third Wednesday in each month, at 7.30 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Engineers' Society of Western Pennsylvania* meets in the Carnegie Library Building, Allegheny, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds informal meetings on the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at 8 p. m.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month, at 7.30 p. m. Address P. O. Box 333.

The *Engineers' and Architects' Club of Louisville* meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday each month at 8 p. m.

The *Western Foundrymen's Association* meets in the Great Northern Hotel, Chicago, on the third Wednesday of each month. B. W. Gardner, Monadnock Block, Chicago, is secretary of the association.

The *Association of Civil Engineers of Cornell University* meets on Friday of each week at 2.30 p. m., from October to May, inclusive, at its association rooms in Lincoln Hall, Ithaca, N. Y.

Local Freight Agents' Association.

The National Association of Local Freight Agents will meet in New York City, at the Broadway Central Hotel, on June 11. The President of this organization is Mr. E. E. Zeigler, Agent of the Pennsylvania at Pittsburgh.

The Civil Engineers' Club of Cleveland.

The Civil Engineers' Club of Cleveland met at the rooms of the Club, Case Library Building, April 9, 1895. Prof. Chas. S. Howe presented a paper entitled "Solar Attachments to Transits," and also gave a description of Mr. John B. Davis' "New Solar Instrument."

American Railway Accounting Officers.

The seventh annual meeting of this association will be held at Detroit, Mich., commencing Monday, May 29, at 10 o'clock a. m. The place of meeting in Detroit has not yet been determined upon. The order of business includes reports from special committees on freight claim accounting, car accounting and on express settlements. Mr. C. G. Phillips, 355 Dearborn street, Chicago, is Secretary of the Association.

West Virginia Society of Civil Engineers.

The civil engineers of West Virginia met at Parkersburg recently and organized a State Association under the name of the West Virginia Society of Civil Engineers and Surveyors. A constitution and by-laws were framed and adopted, and the following officers were then elected: A. L. White, Wheeling, President; J. M. Clark, Kanawha Falls, C. E. Krebs, New Martinsville, and V. A. Dunbar, Parkersburg, Vice-Presidents; William Steenberger, Point Pleasant, Secretary and Treasurer.

Association of Air-Brake Men.

The second annual convention of this association was held in St. Louis last week, the sessions closing on Friday. It was decided to hold the next annual meeting at Boston, and the following officers were chosen for the ensuing year: S. D. Hutchins, Columbus, O., President; C. P. Cass, Monett, Mo., First Vice-President; P. M. Kilroy, Pine Bluff, Ark., Secretary, and Otto Best, Nashville, Tenn., Treasurer. Abstracts of some of the papers read at St. Louis will be found in other columns of this issue.

Chicago Railroad Association.

The Chicago Railroad Association elected the following officers at the recent annual meeting: President, D. W. Cooke, Assistant General Passenger Agent of the Chicago Great Western; Vice-President, C. A. Higgins, Assistant General Passenger Agent of the Santa Fe; Secretary and Treasurer, A. F. McMillan, Chief Clerk of the Michigan Central. Executive Committee: C. A. Cairns, Assistant General Passenger Agent of the Northwestern; F. W. Buskirk, Assistant General Passenger Agent of the Erie; L. Wakely, Assistant General Passenger Agent of the Burlington.

The Western Railway Club.

The April meeting was held on Tuesday of this week in the Banquet Hall of the Auditorium Hotel, Chicago. The first discussion was on Mr. C. A. Goodnow's paper on "The Train Staff System," and then "The Strength of Railway Car Axles" was taken up for topical discussion. The principal subject before the meeting, however, was the M. C. B. Interchange Rules, this discussion being based on the report of the Club Committee presented at the February meeting, on the modifications adopted by the new Interchange Association at Chicago.

Central Railway Club.

The next meeting of this Club will be held at the Hotel Iroquois, Buffalo, N. Y., on Wednesday, April 24, at 10 a. m. The report of the Committee on Revision of the Constitution and By-laws and the report of the Committee on the Rules of Interchange will come up for discussion. Committees will report upon the subjects assigned them as follows: "Management of Steam Heat on Passenger Equipment; Is the Use of a Trap Necessary or Advisable?"—E. D. Bronner, Robert Gunn, John S. Lentz. "Comparative Service Derived from Flues in Locomotive Boilers Working with a Steam Pressure of 125 to 140 lbs. and Boilers Carrying 160 to 200 lbs."—E. A. Miller, F. B. Smith, P. E. Garrison.

Engineers' Club of Cincinnati.

At the February meeting of the club Mr. Geo. W. Passell read a paper on "Wood Working Machinery."

At the meeting in March Mr. G. B. Nicholson read a paper under the title of "Rapid Methods of Making Surveys for Small Scale Maps," which he illustrated by descriptions of surveys made by himself, one of a survey made in 1886 for the location of a wagon road from Lewiston to Virginia City, a distance of about 400 miles, which for the most part was through the Bitter Root Mountains in the northwest part of Idaho. Another survey was of the Mississippi and Missouri rivers, made from the pilot house of a steamboat.

Engineers Club of St. Louis.

The club met on April 3 at 8.30 p. m., President Russell in the chair; 15 members and six visitors present. Joseph Ramsey, Jr., and George B. Leighton were elected members.

Prof. J. H. Kinealy addressed the club on the "Different Methods of Determining the Heat Value of Fuels." Three plans are in common use: The Analytical, Bertier and Calorimetric. In the first method the calorific power is computed from the chemical constituent of the fuel, they having first been determined by analysis. This process was open to the criticism that the heat value of pure carbon had been shown to vary as much as 3 per cent. depending upon the condition of the carbon. This computation also neglected the sulphur. On the whole, however, he considered this plan the best of the three. In the second or Bertier method, the coal was burned in the presence of litharge, the heat value being assumed to be proportioned to the amount of oxygen absorbed from the litharge. This principle has been shown, however, to be erroneous, but the method nevertheless gives good comparative results. The apparatus used in the third method is usually the Thompson calorimeter, in which the coal is burned in such a way as to give up its heat to a surrounding body of water of known weight, the rise in temperature of which is noted. This

method was shown to have a considerable error depending upon the temperature of the water used and the heat absorbed by the apparatus itself. Its accuracy depends upon very close reading of thermometers. This method assumed that complete combustion of the coal occurred, which the speaker doubted. This possibility he proposed to investigate further by analyzing the discharge gases.

Messrs. Johnson, Fish, Moore and Bryan took part in the discussion.

The Railway Signaling Club.

The Railway Signaling Club (Chicago) held its third meeting Tuesday evening, April 9, at the Dearborn street station, Chicago. This club was organized Feb. 25, 1895, for the purpose of advancing the art of signaling. Mr. W. J. Gillingham, Jr., Signal Engineer, Illinois Central Railroad, was elected President, and Mr. G. M. Basford, of the *Railway Review*, Secretary and Treasurer.

The meeting Tuesday evening was attended by Messrs. G. M. Basford, Secretary; W. H. Elliott, Signal Engineer, Chicago, Milwaukee & St. Paul Railway; W. J. Gillingham, President; H. H. Hart, Signal Department, Illinois Central Railroad; H. B. Litchfield, Chicago & Western Indiana Railroad; H. D. Miles, Signal Engineer, Michigan Central Railroad; H. R. Nickerson, Superintendent Terminals, Atchison, Topeka & Santa Fe Railroad; J. W. Peck, Signal Engineer, Chicago & Northern Pacific; H. M. Sperry, Western Agent, The National Switch & Signal Co.; W. B. Turner, Signal Engineer, Chicago & Western Indiana Railroad; V. Spicer, Western Agent, The Union Switch & Signal Co.; H. C. Wilson, Signal Inspector, Chicago & Grand Trunk Railroad; E. D. Wileman, Signal Engineer, Lake Shore & Michigan Southern Railroad. The paper of the evening was by W. B. Turner, on the "Relation of Track and Traffic to Interlocking," and was followed by a full discussion of the paper.

Mr. Nickerson called attention to a code of rules that he has been preparing for the operation of interlocking plants, and a committee was appointed, consisting of Messrs. Miles, Nickerson and Sperry, to formulate a standard code of rules for the operation of interlocking plants, as at present considerable confusion exists, due to the wide difference in the rules now in use on railroads. A committee, was also appointed, consisting of Messrs. Turner, Elliott, Wilson, Peck and Basford, to investigate the question of colors for night signaling.

PERSONAL.

—Mr. Julius C. Brown, President of the Brown Nut Lock Co., of Chicago, died in Kansas City on Wednesday of last week from heart failure.

—Mr. D. Miller, Traffic Manager of the Missouri, Kansas & Texas, has been granted two months leave of absence and will sail for Europe this month.

—Mr. M. T. Fitzpatrick, who has been with the Union Pacific 15 years as General Road Master of the Central Branch, has resigned to accept a similar position with the Kansas City, Fort Scott & Memphis road.

—Mr. Charles E. Wheeler, Superintendent of the transportation department of the Chamber of Commerce, of Cleveland, has resigned to assume the duties of General Manager of the new Cleveland Steel Canal Boat Company.

—Mr. A. G. Brown, for 30 years Supervisor on the Pennsylvania Railroad at Lock Haven, died at that place on April 9, aged 75 years. Mr. Brown had been acting as Supervisor of canals owned by the Pennsylvania for the past three or four years.

—Mr. Thomas R. Robinson, treasurer, and Mr. E. P. Bates general freight agent of the Allegheny Valley Railroad, were arrested at Pittsburgh, April 8 on complaint of the Interstate Commerce Commission, on a charge of granting a rebate between Clarion, Pa., and Buffalo, N. Y., to J. T. Henry, a coal operator at Reynoldsburg, Pa. They gave bail and waived a preliminary hearing.

—Mr. George W. Simonds, President of the Simonds Mfg. Co., of Pittsburgh, died at that city on April 9, aged 63 years. Mr. Simonds was formerly connected with the Westinghouse Brake Company and was one time Assistant Superintendent of the company. He was also the representative of the company in Europe and did much important work in introducing the Westinghouse air brake on European lines.

—Mr. W. H. Fry, who went from the Pullman Car Company to the New York, New Haven & Hartford railroad last year as Superintendent of the Car Department, has just resigned his connection with the railroad company. Mr. John Henney, Jr., the Superintendent of Motive Power of that road, has had his authority extended over the car department for all the lines operated by the New York, New Haven & Hartford railroad.

—Mr. James H. Hill, Tax Commissioner of the Missouri, Kansas & Texas, and Secretary to Vice President and General Manager Purdy, will sever his connections with the company on May 1, in order to accept a position with the Equitable Life Assurance Society, as manager for the State of Wisconsin, with headquarters in Milwaukee. Mr. Hill entered railway service in 1878 as a clerk in the Superintendent's office of the Atchison & Nebraska, now a part of the Burlington system, at Atchison, Kans., and has been with the M. K. & T. since the last receivership, first as Secretary to the Receivers, then in a similar position to the President, until Mr. Purdy's appointment.

—Mr. Frederick Knowland, General Eastern Agent of the Missouri Pacific Railroad, at New York City, died at Plainfield, N. J., April 11, aged 60 years. Mr. Knowland had been with the Union and Central Pacific as freight representative at New York for nearly 30 years up to 1888. Before accepting that position he had been located at San Francisco as Western Agent of the Pennsylvania lines, although in the interim between resigning that position and accepting office with the Central Pacific, he had acted as General Eastern Agent of the New York Central road. In 1888 he was with the New York and New England railroad as General Agent, but left that company four years later and since then has been General Eastern Agent of the Missouri Pacific railroad.

—Mr. George M. Phelps, Treasurer of the American Institute of Electrical Engineers and publisher of the *Electrical Engineer*, of New York, died at his home in Brooklyn, on April 11, of pneumonia, after a very short illness. Mr. Phelps was a son of George M. Phelps, the well-known inventor of the Phelps telegraph instrument, the Phelps telephone and other electrical devices, and was born in Troy, N. Y., in 1843. In 1861 he became assistant

to his father, who was Superintendent of the American Telegraph Co., and he has ever since been identified with electrical interests. He was with the American Telegraph Co., and its successor, the Western Union Telegraph Co., until 1879, as assistant to his father, who had become Superintendent of the factory in New York City. He became Superintendent of the Western Electric Co. in 1879, when the latter company purchased the manufacturing business of the Western Union, and he held that position until 1885. Some months later he went to the *Electrician and Electrical Engineer*, then a monthly edited by Mr. Franklin L. Pope. He had been with that paper ever since and when the name was changed in 1890 to the *Electrical Engineer* and the paper issued weekly, he became President of the company. He was a charter member of the American Institute of Electrical Engineers and was elected one of its managers in 1885, and since 1887 has been Treasurer, holding that office at the time of his death. He had been a member of various standing and special committees of the Institute.

—A number of important changes in the organization of the Southern Railway Co. have been announced this week. The separate officers of General Manager of the two divisions of the road, the Eastern and the Western, have been abolished, and Mr. W. H. Green, who has held that office on the Eastern Division, which includes the lines of the Richmond & Danville, has been made General Manager of all the lines now operated by the Southern Railway. Mr. C. H. Hudson, who became General Manager of the Western System, comprising the lines of the East Tennessee, Virginia & Georgia, of which he was General Manager, when that road was consolidated with the Southern, becomes Chief Engineer on all the lines of the Southern Railway. He succeeds in the latter office, Mr. C. M. Bolton, who has been Chief Engineer since 1882 and was Division Engineer of the railroad for several years prior to his appointment as Chief Engineer. The office of Assistant General Superintendent has been created and Mr. J. S. B. Thompson, now Superintendent of the first division with office at Danville, is to be the first incumbent of the division, his headquarters being at Atlanta, Ga. Mr. D. W. Lum, who has been General Roadmaster of the Western Division, and was formerly Chief Engineer of the East Tennessee, Virginia & Georgia, has been made Superintendent of Bridges and Buildings of both divisions, his headquarters remaining at Washington. Mr. J. A. Dodson, formerly Division Superintendent of the Richmond & Danville and recently General Roadmaster of the Western System of the Southern, becomes General Roadmaster for the entire system.

ELECTIONS AND APPOINTMENTS.

Cumberland Valley & Martinsburg.—A directors' meeting was held at Martinsburg, W. Va., on April 14, to elect officers for the ensuing year, and Maury C. Kennedy, of Chambersburg, Pa., was elected President in place of Thomas B. Kennedy, who declined re-election. M. T. Ingles, was re-elected Secretary, and James B. Russell, of Winchester, Va., Treasurer.

Florence & Cripple Creek.—The general offices have been removed from Florence to Denver, the superintendent only remaining in Florence.

Gulf, Beaumont & Kansas City.—C. C. Allen has been appointed to the position of Land Commissioner, with headquarters in Beaumont, Tex. Mr. Allen was formerly and for 10 years Land Agent for the Gulf, Colorado & Santa Fe, and later connected with railroads in North Texas.

Guyandotte & Atlantic.—The incorporators of this company in West Virginia, are as follows: Francis M. Pierce, 221 W. 43d street, New York; John D. Miller, 76 Rodney street, Brooklyn, N. Y.; John E. McIntire, 538 Putnam avenue, Brooklyn, N. Y.; T. R. Magee, Prospect avenue, Brooklyn, N. Y. and Earle A. Qorrill, 150 W. 66th street, New York.

Illinois, Indiana & Michigan.—The annual meeting of the railroad at Michigan City, Ind., on April 11, elected Congressman William Alden Smith, Thomas Hefferan and F. H. Jewell, of Grand Rapids; J. E. Wyman, of New York, and H. D. Tuttle, of Boston, Directors. The road is to run from the Indiana State line to connect with the Chicago & West Michigan and Lake Erie & Western. The right of way has been secured and 12 miles of track laid between New Buffalo and Michigan City, Ind.

Indiana, Illinois & Iowa.—C. W. Cook, General Freight and Passenger Agent of the road having resigned, S. S. Whitehead, who has been connected with the "Three I's" for a long time, has been appointed his successor.

Mexican.—Mr. Charles A. Browne, Assistant Treasurer, has resigned to accept another position with this company. Jay A. Hendry, now General Traveling Auditor, has been elected Assistant Treasurer, with headquarters in the City of Mexico, vice Charles A. Browne, resigned, who, it is understood, will take an important position in the financial department at Boston.

New York, New Haven & Hartford.—W. H. Fry having resigned the position of Superintendent of Car Department, the duties connected with the same, have been assigned to John Henney, Jr., Superintendent of Motive Power.

New York & New England.—W. P. Condon, formerly Roadmaster on the Lehigh Valley, has been appointed Roadmaster on the New York & New England.

Philadelphia & Reading.—L. Horton, Jr., has been appointed Superintendent of the Philadelphia & Reading Railroad telegraph system to succeed the late E. R. Adams. Mr. Horton was until recently with the Baltimore & Ohio road.

Pittsburgh, Cincinnati, Chicago & St. Louis.—The directors at Philadelphia elected the following officers: President, George B. Roberts; Vice-Presidents, J. B. McCrea, J. T. Brooks and J. E. Davidson; Secretary, S. B. Liggett; Assistant Secretary, Stephen W. White; Treasurer, T. H. B. McKnight; Assistant Treasurer, M. C. Spencer.

Plant System.—T. J. Richardson has been appointed Master of Trains on the High Springs Division, between Dupont, Ga., and Lakeland, Fla.; High Springs, Fla. and Gainesville, Fla.; Fort White, Fla. and Lake City, Fla. Also the Silver Springs, Ocala & Gulf Railway, with office at Ocala, Fla.

The following additional appointments are announced: J. P. Renfro, Supervisor First Division, Lakeland to Juliette and Gulf Junction to Homosassa, Fla.; W. B. Haynes, Supervisor Second Division, Gulf Junction to

Ocala, Juliette to High Springs and High Springs to Gainesville, Fla., and A. Gill, Supervisor Third Division, Santa Fe Junction to Dupont and Lake City Branch.

Port Jervis, Monticello & New York.—The property was turned over this week to the new company controlled by the syndicate composed of ex-Congressman Charles D. Haines, of Kinderhook, N. Y., Andrew G. Haines, of Sandy Hill, Lafe Pence, the Populist ex-Congressman from Colorado, and others. The new officers are Charles D. Haines, President; Lafe Pence, Vice-President; Andrew G. Haines, Treasurer; W. E. Scott, Secretary, and Stephen D. Lake, of Hudson, General Superintendent.

San Antonio & Gulf Shore.—There has been another change in the control of this short railroad in Texas, and the present directors are George G. Clifford, George W. Russ, John J. Stevens, Otto Koehler and T. W. Smith. Vice-President Colly Montgomery and H. E. Jones retire from the directory. Ex-Governor Ireland remains president. General Russ will have charge of construction. The affairs of the company are now in the courts.

Southern.—In accordance with action of the Board of Directors, the following appointments and changes in organization take effect April 20: W. H. Green to be General Superintendent of the entire system, with office at 1,300 Pennsylvania avenue, Washington, D. C., reporting to the Third Vice-President; C. H. Hudson to be Chief Engineer, vice C. M. Bolton, resigned, with office at 1,300 Pennsylvania avenue, Washington, D. C., reporting to Third Vice-President. The positions of General Manager of the eastern and western systems respectively, are abolished.

The duties of the General Superintendent and Chief Engineer are defined as follows by Vice-President Baldwin:

The General Superintendent will have full charge of all transportation matters, including all stations and terminals. He will be assisted by an Assistant General Superintendent, with headquarters at Atlanta, Ga., who will report direct to him. Division Superintendents will report as directed by him. The Superintendent of Car Service and the Superintendent of Telegraph will report to the General Superintendent. The Chief Engineer will have charge of all new construction, as well as maintenance of roadway and track and the maintenance of bridges, buildings and other structures. He will be assisted by a General Roadmaster and a Superintendent of Bridges and Buildings, with headquarters at Washington, D. C.

J. S. B. Thompson has been appointed Assistant General Superintendent, with office at Atlanta, Ga. N. J. O'Brien has been appointed Superintendent First Division, vice Mr. Thompson, promoted. J. A. Dodson has been appointed General Roadmaster, with headquarters at Washington, D. C., and will have charge of the maintenance of roadway and track. Division Roadmasters report to and receive instructions from him. D. W. Lum has been appointed Superintendent of Bridges and Buildings, with headquarters at Washington, D. C., with charge of the maintenance of bridges (including trestles and culverts), buildings, and other structures. Division Bridge Supervisors report to and receive instructions from him.

Staten Island.—The stockholders of the Staten Island Railway Company held their annual meeting at New Brighton, N. Y., on April 2, electing the following Directors: Frank S. Gannon, Joseph Tate, C. H. Bass, August Horrmann, Kintzing P. Emmons, G. F. Kreischer, J. J. Winants, L. DeJonge, Jr., C. A. Canavalle, J. M. Fitzgerald, E. P. Goodwin, William King and Louis Beaziger. At the meeting of the Directors on April 8, the following officers were re-elected, namely: Frank S. Gannon, President; Joseph Tate, Vice-President, and Edward Curry, Secretary and Treasurer. This road is a leased line of the Staten Island Rapid Transit.

Tuscarora Valley.—At Port Royal, Pa., April 8, the annual meeting was held and these officers elected: Thomas S. Moorehead, President; Wilberforce Schwyer, Vice-President; John C. Morehead, Secretary and Treasurer.

Wabash.—L. S. McClellan has been appointed District Passenger Agent of the Wabash, with headquarters at Louisville, Vice Robert F. Kelley, transferred to Buffalo as Eastern Division Passenger Agent.

Wisconsin Central.—C. J. Broughton has been appointed District Passenger Agent of the Wisconsin Central, with headquarters at Pittsburgh, Vice W. P. Foster, who retires on account of ill-health.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Atlantic & Lake Superior.—The company will apply to the Parliament of Canada, at its next session, for the passing of an act authorizing it to enter into agreements for the purchase or lease of or making working arrangements with the Central Counties Railway Co., Canada Atlantic, Ottawa, Arnprior & Parry Sound, Grand Trunk, Brockville, Westport & Sault Ste. Marie, Drummond County, United Counties, South Shore and with other companies, and to authorize the construction of branch lines to a harbor or Lake Huron. This is the project promoted by Mr. C. N. Armstrong and Senator Thibaudeau, of Montreal. The foreman is now in London in the interest of the project. The Montreal & Sorel, has been leased and the Baie des Chaleurs, in Quebec, and the Great Eastern roads, will be included in the scheme, being now controlled by its incorporators.

Baie des Chaleurs.—Messrs. N. K. & M. Connolly, of Quebec, Que., who have the contract for building the continuation of the railroad from Caplin to Paspebiac, N. B., are making active preparations for commencing operations, and hope to have it completed by September next. The line now forms a part of the Atlantic & Lake Superior, and forms a junction with the International Railway at Metapedia. A large bridge over the Bonaventure river is still to be built.

Buffalo & Susquehanna.—The contract for grading the extension from Galeton to Brookland, Pa., 11 miles, has been let to Frank Greco, of Bradford, Pa. Work was begun April 15. This road will ultimately be extended on to Genesee Forks, thus giving Potter County a northern outlet and connect with the Erie at Wells-ville. Great forests of timber lately purchased by F. H. & C. W. Goodyear, of Buffalo, along this extension, will thus be brought into the market. M. E. Olmsted, Harrisburg, Pa., is President.

Chicago, Lake Shore & Eastern.—This company was incorporated in Indiana, last week, with a capital stock of \$500,000, the incorporators being Chicago capitalists. The directors are W. G. Brimmon, E. C. Crane, F. L.

Wean, J. S. Keefe and E. P. Prentice. The road will be 20 miles in length and will extend from the west line of Hobart township, in Lake county, Indiana, in a west and northwest direction to the Illinois State line.

Cleveland, Wooster & Muskingum Valley.—Track-laying has been completed on the extension of this Baltimore & Ohio branch in Ohio, south of Wooster, from Wooster, in Wayne county, to Millersburg, in Holmes county, a distance of 18 miles. The line has been in operation from Lodi, on the Akron Division, to Wooster, for several years, and the extension which connects at Millersburg with the Cleveland, Akron & Columbus road will be put in use immediately. Part of the way the C., A. & C. line is parallel to the new road.

Cripple Creek Belt.—Incorporation papers have been filed in Denver by Spencer Penrose, R. N. Mayfield, E. B. Maghee, A. E. Mayfield and J. R. Freeman, Jr., for the purpose of building a belt line between Cripple Creek and Altman, including other districts tributary to Cripple Creek. The capital stock is \$300,000.

Cumberland Valley.—Mayor Stoner vetoed the ordinance giving the company the right to construct an extension of its Mont Alto branch through Waynesboro to the Geiser Works, at a cost of about \$20,000, but Council has passed the ordinance over his veto. The Western Maryland opposes the extension on the ground that it will take away from it considerable of the freight traffic it now handles.

Darien & Western.—This railroad is now being operated in southeastern Georgia for 30 miles north west of Darien, Ga., its southern terminal point. The line was built during the last few months by northern capitalists, Mr. F. M. Baker, the General Superintendent of the Addison & Pennsylvania Railroad, being Chief Engineer and General Manager of the rail road during construction. The line now operated extends from Darien, a point near the mouth of the Altamaha River, north and west through McIntosh County, connecting with the Florida Central & Peninsular and thence to the town of Middleton, about 10 miles beyond the junction with the Florida Central & Peninsular. Mr. W. F. Cochran, of Yonkers, N. Y., is President of the company, and George D. Mackey, 16 Nassau street, New York, is Treasurer.

Fort Dodge & Pocahontas.—This corporation has been organized as a local company at Fort Dodge, Ia., to undertake the building of a railroad from that town northwest to Pocahontas, Ia. The object of building the railroad is to give Fort Dodge a direct connection with the rapidly developing coal fields in Pocahontas county. The railroad to be built will be about 30 miles in length. The projectors hope to raise a large part of the funds needed to build the line through local township subscriptions.

Grass Creek.—Tracklaying on the Grass Creek road, between Grass Creek Junction, Utah, on the Union Pacific and the coal mines of the Utah company, is expected to commence in a few days. This work will be done by the Union Pacific before June 1.

Great Northern.—It is reported that Foley Bros., of St. Paul, have secured a contract to build 50 miles of road on the Fosston survey west from Sandstone, Minn., on the Hinckley line.

Hudson River & Cornell.—This company was incorporated at Albany, N. Y., this week to build and operate a railroad 10 miles long from Croton-on-Hudson to Cornell; capital, \$100,000. The directors are: J. S. Coleman, C. J. Ryan, H. H. Brown, B. F. Coleman, C. J. Ryan, Jr., W. Kennelly and J. B. Greene, of New York City, and Charles Dayton, of Brooklyn.

Inter-Mountain.—Articles of incorporation were filed recently in Denver by this company to construct a mining railroad in Boulder county. The company has a capital of \$300,000, and Samuel L. Brown, Jacob C. Switzer, James Cowie, Eugene Canston and George G. Findo are the incorporators. The proposition is to construct a tram system to connect the mining district of Ward and adjacent camps with Boulder, and possibly with Denver. Shipments of 500 tons of ore a day are anticipated with the reduced cost of transportation this proposed railroad would give.

Jackson.—This railroad from McManus station on the Yazoo & Mississippi Valley Railroad to Jackson, La., is nearing completion, and within a few days daily trains will be put on.

Kansas City & Northern Belt.—This company was organized in Kansas last week with a capital stock of \$500,000. The road as proposed is to be built for the purpose of improving the "north bottoms" of Kansas City, over 200 acres of land now practically useless. The line will extend from the Kansas State line along the line of the Missouri river to Quindaro. It will be built at once and will be followed by the construction of branches to Argentine and the limits of Kansas City and to Leavenworth on the north. The incorporators of the new company are W. L. Parkinson, of Ottawa, J. S. Stockton, S. S. Mathews and N. McAlpine, J. W. Jenkins and Thomas J. Barker, President of the Wyandotte National Bank, all of Kansas City, Kan.; A. B. Matthews, of Kansas City, Mo.; J. W. Taylor, of Leavenworth, and D. E. Henderson of Kansas City, Mo. The incorporators will ask for a right of way across the levee in Kansas City.

Oregon City & Willhoit Springs.—This company has been recently incorporated in Washington, and proposes to build a railroad from Oregon City to Marquam, Clackamas County.

Ottawa, Arnprior & Parry Sound.—William Heald, of Arnprior, Ont., has been awarded the contract for the construction of a section of the road east of Parry Sound. Work will be commenced immediately. The names of other contractors and an account of the construction work now going on was given in these columns last week.

Pennsylvania.—The new construction work on the several divisions of the Pennsylvania Railroad in Pennsylvania, which was stopped about a year ago on account of the falling off in traffic and earnings is now likely to be revived and pushed to completion during the coming summer. The plans now spoken of as likely to be taken up immediately, promise a season of considerable activity during the remainder of the year in this class of work. One of the first branches to be built will probably be the new line to Bustleton, north of Philadelphia. The right of way for this line has been already secured, and some of the grading has been finished. The construction of the branch will give the Pennsylvania an outlet to the New York division and it is also proposed to extend it still further to connect with the Trenton cut-off, just before it connects with the New York division. The new branch will relieve the New York division of a considerable share of heavy traffic which now goes over it. Other branches to Roxborough

and other suburban towns may also be taken up in the spring, but the chances of their completion has been considerably interfered with by the competition of the electric railroads in and about Philadelphia, so that it is not at all certain that their construction will finally be undertaken.

Port Jervis, Monticello & New York.—This property, which has been under the control of Benjamin Ryall as Receiver for about two years was this week transferred to its new owners by Charles D. Haines, of Kinderhook, N. Y. The road now in operation extends through Sullivan County, north of Port Jervis, to Monticello, with a branch to Summitville, about 40 miles altogether. The new owners contemplate making important improvements and several extensions will probably also be undertaken beyond Monticello, northeast down the Rondout valley, and perhaps also northwest toward Jeffersonville. In reorganizing the railroad the bonded indebtedness of the company was reduced from \$615,000 to \$225,000, on which sum it was estimated that the company could certainly earn 4½ per cent. interest.

San Antonio & Gulf Shore.—The purchase of the control of this property by one of the present directors, Mr. Geo. G. Clifford, and those friendly to him, probably indicates that the company will soon be released from the legal complications which have interfered with the project for some months past. The affairs of the corporation are now in the Texas State Courts. The present property of the line is simply a graded railroad bed west of San Antonio, Tex., about 15 miles in length, to a point near Sutherland Springs. Dr. Clifford intends to complete the road for operation to that point without delay and to extend it slowly toward the Gulf shore, the original terminus of the road.

San Francisco & San Joaquin Valley.—Mr. W. B. Story, recently elected Chief Engineer of the company, is rapidly organizing the engineering department of the company and organizing parties of surveyors. He expects to head a party personally to start out from south of Stockton within a few days to make a reconnaissance of the entire line to Bakersfield, which point is about 350 miles south of Stockton.

Southern Pacific.—A short section of double track on the line in Louisiana west of New Orleans is to be built during the coming summer. The first work to be done on the second track will be between Baldwin and Franklin, La., and the purchase of the additional right of way between these points, which are about four miles apart, has already begun.

South Jersey.—The United States Circuit Court at Philadelphia has authorized Receiver Frances I. Gowan to issue Receiver's certificates to the amount of \$100,000. The funds will be used first to pay off long standing claims for materials and supplies and wages due employees, and for important improvements to the road bed to prepare it for the coming summer traffic. About 12 new stations will be built on the southern end of the line and it is also probable that the short extension to complete the line into Ocean City from Petersburg, N. J., will be undertaken at once.

Tampico & Rio Grande.—The Mexican Government has granted a concession with a subsidy to this railroad to be built from Barroteran, Coahuila, to Nuevo Laredo, thence down the Rio Grande River, thence to Tampico. The concession was secured by Chicago capitalists.

Union Pacific, Denver & Gulf.—Bids for the construction of the extension north from Forbes Junction to Walsenburg have been invited. Eight of the 24 miles was graded by the company pending the settlement of the question of rental with the Denver & Rio Grande. The latter company declined to reduce the rental charge for the use of its tracks between Trinidad and Pueblo, and the Gulf road will construct its own line as soon as the funds can be secured.

Victoria, Vancouver & Westminster.—This company has been incorporated to build a line from near Garry Point, on the Fraser river, through Richmond, South Vancouver and Burnaby to Westminster, with a branch to Vancouver.

Virginia, Fredericksburg & Western.—Meetings are being held along the route of this proposed road in Virginia to secure local interest and aid for the project. At a meeting at Fredericksburg, Va., last week, there were present ex-Mayor Robert T. Clarke, of Bridgeport, Conn.; Hon. Frank F. Rodgers, ex-Auditor of Connecticut; William C. Haight, President of the proposed road, of Bridgeport, Conn.; C. A. Frays, S. H. Leszynski, and Major Powell, of New York; W. A. Hawkins and George B. Jones, of Richmond; all interested in the project, which is for a line in the so-called northern neck of Virginia.

White River Valley.—J. W. Dean, with a party of civil engineers, began a preliminary survey of the route last week, and expect to finish running the line in four weeks. The projected line extends from Newcastle, Col., to Meeker.

GENERAL RAILROAD NEWS.

Atlantic & Pacific.—The sale of the \$18,794,000 first mortgage six per cent. bonds on the request of the committee representing the holders of the Atlantic and Pacific 4s, which was to have taken place in New York on April 15, has been adjourned, a temporary injunction obtained from the New York Supreme Court having been served on behalf of the Atchison and St. Louis & San Francisco companies and their receivers and the Union Trust Co. The grounds alleged in the application for the injunction were that the Atlantic & Pacific Railroad, with the other Atchison lines, "forms one general system of railroad, each part of which is more or less dependent upon the other parts, and which is much more valuable as a whole than if broken in separate parts," and that in the present condition of the Atchison reorganization scheme the sale of the 6s on the demand of the holders of the four per cent. bonds will seriously interfere with the reorganization. The Atlantic and Pacific Committee will make an immediate application for a dissolution of the injunction.

Chester & Lenoir.—This road has joined in the boycott against the Seaboard Air Line and has discontinued connection with it. The management of the Chester & Lenoir has closed the station at Chester, S. C., and made arrangements with the Southern Railroad to handle all the business. It was this contemplated arrangement which gave rise to the rumor published in the last issue of the *Railroad Gazette* that the Southern was about to absorb the Chester & Lenoir.

Chicago & South Side Rapid Transit.—At a meeting of the Board of Directors it was decided to ask the stockholders to appoint David R. Lewis, George T. Smith, James A. Fullenwider or William B. Walker their attorneys, with complete power to formulate a re-

organization scheme and to assess the stock such an amount as seems necessary. The interest on the first mortgage bonds, due April 1, was defaulted and the committee of stockholders appointed to devise some financial plan has failed to come to any agreement and has made no report. This document that the stockholders are asked to sign is remarkable for the fact that it places them entirely in the hands of men who, while they certainly should represent no interest, but that of the stockholders, yet are themselves strongly identified with holdings of the bonds. The sentiment is not favorable to such a plan and has been adversely criticised by a number of the stockholders.

Grand Rapids & Indiana.—The annual report of the company for 1894 gives the results of operations of all lines as follows:

	1894	1893	Inc. or Dec.
Gross earnings.....	\$2,464,956	\$2,807,287	D. \$342,331
Operating expenses, taxes, etc.	2,037,985	2,461,850	D. 423,865
Net earnings.....	\$426,970	\$345,437	I. \$81,534
Gross earnings per mile.....	4.162	4.741	D. .579
Net earnings per mile.....	.720	.583	I. .137

The company in 1891 was obliged to ask the Pennsylvania Railroad to provide the money for interest on the first mortgage guaranteed 7 per cent. bonds. That company had up to Jan. 1, 1895, advanced \$681,939. The amount of unpaid coupons on the second mortgage 6 per cent. bonds on Jan. 1, 1895, was \$553,050. The work of extending the 7 per cent. bonds into 4½s has not progressed to the extent hoped for. The amount extended to date is \$2,955,000, leaving \$2,420,000 7 per cent. bonds outstanding. The net floating liability at the end of the year, without deducting Treasury bonds, was \$1,723,577, an increase of \$199,601. The largest creditor is the Pennsylvania Railroad, to the amount of \$1,409,249. As a partial offset to the floating debt, the balance sheet shows \$123,011 due by other companies, \$85,167 due by agents and conductors, \$165,939 cash and \$4,063 bills receivable. Freight earnings decreased 14.01 per cent. and total tonnage decreased 18.67 per cent. Passenger earnings decreased 13.53 per cent. The earnings per passenger per mile were 2.293 cents, a decrease of .129 cents. Freight earnings were .884 cents per ton per mile, an increase of .021 cents. The income account of Grand Rapids & Indiana alone showed earnings for interest \$301,419, and interest charges were \$599,344, leaving a deficit of \$297,924. The deficit of the Cincinnati, Richmond & Fort Wayne for the year was \$29,574. The surplus of the Traverse City Railroad for the year was \$230. The deficit of the Muskegon, Grand Rapids & Indiana road was \$21,976.

Green Bay, Winona & St. Paul.—Judge Seaman, at Milwaukee, has refused the application of William S. Mowrey for a decree of foreclosure for the railroad company and granted the motion consolidating the Mowrey suit with that of the Farmers' Loan & Trust Co. Under Judge Seaman's ruling the railroad company will remain in the hands of the Farmers' Loan & Trust Co. pending the determination of a new bill to foreclose the consolidated mortgage, which bill has been filed together with the second amended supplemental bills.

Houston, East & West Texas.—The governor of Texas has vetoed the bill to authorize the Houston East & West Texas Railway Co., to lease for the term of 99 years the Houston & Shreveport Railroad, incorporated in Louisiana on the ground that it would be a violation of the clause of the constitution, which reads: "No railroad company, organized under the laws of this state, shall consolidate by private or judicial sale, or otherwise, with any railroad company organized under the laws of any other state, or of the United States."

Leamington & St. Clair.—The Canada Southern is applying to the Dominion Parliament for authority to lease this road, which is now operated by the company. It is 16 miles long, from Lake Erie, near Leamington, to Combes, Ont. The lease made in 1889 gave the Canada Southern the right to purchase the road at any time during the term of the lease.

Little Rock & Memphis.—The sale of the railroad for the benefit of the first mortgage bondholders has been postponed from April 18 to June 19.

New York, Lake Erie & Western.—The Receivers of the company have been authorized by the decision of Judge Lacombe, of the New York Supreme Court, to issue \$4,000,000 in Receivers' certificates bearing six per cent. interest. Judge Lacombe requires that the Receivers receive not less than par by the sale of these certificates. The receivers in their petition stated that the principal amounts now due by them included traffic balances of \$463,000; materials and supplies, \$2,275,000; installments due on contracts, \$519,000, beside over \$1,070,000 in car trusts and in equipment contracts which would become due before Jan. 1, 1896, and which it would be necessary to meet in order to reserve the equities in equipment on which payments amounting to \$6,000,000 have already been made.

Northeastern (Georgia a.)—This railroad was bought at foreclosure sale, at Atlanta, Ga., on April 16, by Governor Atkinson, who bid it in for the State of Georgia. His bid was \$100,000, and it was the only one made. The road extends from Athens, Ga., to Lula, on the Southern. The line is 40 miles long. Several years ago the State of Georgia endorsed \$260,000 of the Northeastern's bonds, and when default was made in the interest payments on these bonds by the Richmond & Danville and Central of Georgia, the operation of the road was assumed by the State of Georgia. The old issue of state bonds has recently been refunded.

Northern Pacific.—The receivers of the company report the earnings for January as follows:

	1895.	1894.	Inc. or Dec.
Gross earnings.....	\$1,017,812	\$862,098	I. \$155,714
Oper. expenses.....	859,128	662,002	I. 197,126
Net earnings.....	\$158,384	\$199,495	D. \$41,111
Other income (def).....	132,714	26,537	D. 106,177
Total income.....	\$291,098	\$226,033	D. \$65,065
Charges paid.....	518,095	448,796	I. 69,299
Deficit.....	\$192,125	\$222,743	I. \$30,618
Charges accrued not paid	442,226	477,194	D. 34,968

	1895.	1894.	Inc. or Dec.
Gross earnings.....	\$998,606	\$781,035	I. \$217,571
Oper. Expenses.....	728,613	611,315	I. 117,298
Net earnings.....	\$269,592	\$169,719	I. \$99,873
Other income.....	25,617	10,585	D. 15,032
Total income.....	\$295,209	\$180,304	I. \$114,905
Charges paid.....	502,167	440,921	I. 61,246
Deficit.....	\$206,857	\$230,606	I. \$23,749
Ch'g's ac. no pd.....	438,893	474,826	D. 35,933

From Aug. 18, 1893, the date of the appointment of the receivers, to Feb. 28, 1895, the gross earnings were \$26,735,027; operating expenses, \$17,801,804; net earnings, \$8,933,223; other income, \$895,705; making total income,

\$9,628,928; charges paid, \$9,722,650; leaving a deficit of \$93,722; charges accrued not paid were \$8,247,241.

Omaha & St. Louis.—Judge Woolson, has announced a decision in the United States Circuit Court in Council Bluffs, in the case of the United States Trust Co., foreclosing the mortgage on this road and ordering that the road be sold. The company has defaulted in the payment of interest from 1891. The amount of the bonds, \$725,000 and accrued interest amounts to \$595,002.

Oregon Railway & Navigation Co.—The committees of the collateral trust and consolidated mortgage bonds, have agreed upon a plan of reorganization which provides that a general mortgage of \$21,500,000 at four per cent. interest is to be issued, into which the present outstanding obligations are to be funded. The collateral trust bonds are to receive 50 per cent. in the new four per cent. bonds and 65 per cent. in new preferred stock. The consolidated bonds are to receive par in the new 4's, 2½ per cent. in cash and 37½ per cent. in preferred stock. The stock of the company is to be assessed \$8 per share, for which preferred stock at par will be given. Of the new four per cent. bonds, \$5,000,000 will be held in the treasury to retire the six per cent. bonds of 1909 when they mature. The foreign interest in the securities of the company are committed to the plan, the success of which is therefore regarded as assured.

Southern.—The following table gives a corrected statement of the earnings of the Southern Railway for the seven months from July 1 to Feb. 28.

Gross earnings.....	\$11,498,894	I. \$323,232
Operating expenses.....	7,557,628	D. 169,759
Net earnings.....	\$3,941,266	I. \$402,291

Tennessee Centr. a.—We have received from Col. Jere Baxter, President of this company, the following letter referring to an article printed in this column last week, in regard to a suit reported to have been brought against the company in the local courts of Cumberland County, Tenn., to adjudicate a claim of \$100,000: I desire to state that no such suit has been brought, neither can it be, because the company has no liability and is in no way embarrassed. The work is progressing rapidly with 600 men now at work on the road. We expect to have 100 miles of new road in operation inside of eight months.

Texas, Santa Fe & Northern.—In the suit of the Farmers' Loan & Trust Co. against this railroad for a foreclosure under the mortgage bonds of the company, Judge Laughlin, at Santa Fe, N. M., has granted a decree ordering the sale and appointing ex-Deputy to Congress Antonio Joseph special master for the purpose. The case has been some years in court, and this is a victory for the trust company. Over \$900,000 bonds and claims are involved. The road extends from Espanola to Santa Fe, a distance of 40 miles, and is now in the hands of a receiver.

TRAFFIC.

Commission Decision on Fruit and Vegetable Rates.

The Interstate Commerce Commission, through Commissioner Clements, has rendered an opinion in the case of the Truck Farmers' Association, of Charleston against the Pennsylvania Railroad Company and others forming through lines from Charleston, S. C., to New York and other northeastern points. It is decided that:

Where, on shipments of strawberries and vegetables from Charleston destined for New York, delivery is made by the roads at the terminus of the rail line in Jersey City, in computing the total cost of transportation to New York the expense of carriage over from Jersey City is to be added to the rate charged to that point.

In case of a change of delivery of such shipments from New York to Jersey City and the maintenance after the change of the same rates to the latter as had been in force to the former city for a series of years preceding the change, the carriers are charging for a less service the compensation which they had presumably deemed adequate for a greater, and the rates as applied to Jersey City are prima facie excessive.

Where a carrier pays mileage for a car which it employs in the service of shippers, it is the carrier and not the party or company from whom the car is rented who furnishes the car to the shipper, and in such case there is no privity of contract between the car owner and the shipper.

It is the duty of the carrier to furnish an adequate and suitable car equipment for all the business it undertakes, and also whatever is essential to the safety and preservation of the traffic in transit.

When carriers undertake the transportation of perishable traffic requiring refrigeration in transit, ice and the facilities for its transportation in connection with that traffic are incidental to the service of transportation, and the charge therefor is a charge "in connection with" such service within the meaning of Section 1 of the act to regulate commerce, in respect to the reasonableness of which the carrier is subject to that provision of the statute.

The commission, applying these general principles, held, under the evidence in this case, that on shipments of strawberries from Charleston to Jersey City the charge of two cents per quart for refrigeration en route is excessive; that the charge, therefore, should not exceed 1½ cents, and that the total charge per quart for the service of transportation on such shipments and necessary service "in connection therewith," including refrigeration, should not be in excess of six cents a quart; that 1.4 cents per package should be deducted from the rate on vegetables shipped in standard barrels or barrel crates from Charleston to Jersey City in cases where the delivery of such vegetables has been changed from New York to Jersey City without a change in rates, and that the rate on cabbages shipped in standard barrels or barrel crates from Charleston to Jersey City or New York should not exceed three-quarters of the rate on potatoes so shipped.

The Seaboard Air Line.

This company has won its suit to compel the Nashville, Chattanooga & St. Louis, operating the Western & Atlantic, to cease discriminating against the Seaboard Air Line. Immediately after the appearance of the circular of the Southern Railway and Steamship Association cutting off through traffic arrangements with the Seaboard Air Line, the latter entered a suit in the United States Court at Atlanta against the N. C. & St. L., as a member of the Association, asking that it be enjoined from participating in the "boycott," on the ground that the lease under which it operated the Western & Atlantic contained a specific clause requiring all connecting railroads to be dealt with on equal terms. The injunction is granted as asked for, but the Seaboard Air Line is required to give a bond in \$15,000 to guarantee the payment of freight charges.

At the beginning of this week the Seaboard Air Line announced a further reduction in passenger fares be-

tween Eastern points and Atlanta, most of the rates being about \$2 less than the very low ones which were put in effect in the first week of March.

Passenger Rates from Florida.

Florida papers report that the sharp competition between the Atlantic Coast Line and the Florida, Central & Peninsular for the patronage of the hotel helpers coming north at the end of the season, resulted last week in the reduction of rates to \$8, Jacksonville to New York. On April 11 the two roads took about 400 people out of Jacksonville. The local papers reported that the competing roads had agreed that their trains should not race, but reports from Washington indicate that one of the trains got in several hours in advance of its competitor and seemed to feel very proud of the fact.

Jacksonville papers report that brokers in that city are selling tickets to Chicago at \$5 and \$6 less than the regular rates.

Chicago Traffic Matters.

CHICAGO, April 17, 1895.

Eastbound shipments for last week show a decrease in grain, probably accounted for by the extra large shipments that went forward under the reduced rates and by the holding up for the opening of navigation. It is significant that notwithstanding the inducements offered by low rates the movement is not appreciably increased.

The action of the Alton in giving notice to its eastern connections that it would cancel through billing to Illinois points west of its Joliet and East St. Louis line will benefit the Chicago merchants who have been complaining to the State Commissioners because jobbers from Michigan and Indiana were able to undersell them by reason of the proportional rates taking the official classification as against the Illinois and Western classifications. It will be remembered that the matter was brought to the attention of the Board and that since then several attempts have been made to arrive at some agreement between the roads and the Chicago jobbers which have not yet been entirely successful. The Eastern lines are attempting to get even with the Alton by cutting off all prating with it, but it is questionable whether they will make anything by doing so. The record of the Alton in fighting "boycotts" heretofore is such that it is pretty safe to wager that it will come out ahead in the present contest, as well as obtain a goodly amount of free newspaper advertising in this city.

The Western roads have had a "tempest in a tea pot" the past week over homeseekers' excursions. The Atchison advertised an "irrigation" excursion from interior points on its lines in Kansas to Rocky Ford, Colo., at \$5 for the round trip for April 9 with a 10 days' return limit. The Rock Island, the Burlington and the Union Pacific at once protested and announced that they would run similar excursions, the Burlington finally going so far as to announce a rate of \$10 one way between the Missouri River and Colorado points, thus reducing the through rate \$7. The Atchison defended its action on the ground that it was for business purely local to itself and not tributary to the agreement. The other lines claimed that it would have the effect of cutting the Denver rates, on account of the close proximity of Rocky Ford to that city and the opportunity afforded for a scalp. During the discussion in the association raised by this and other questions, the Rock Island became convinced that the Union Pacific was not playing fair, that road having given notice to the chairman that it would meet competition, and filed notice that it too would be obliged to ignore the association, or as the notice reads, "protect ourselves." The chairman promptly ruled the notice not in order, but the Rock Island persisted that it had a right to give the notice, and that its own grievance was against not only members of the association in embryo but also lines who have not yet joined. The outcome of the matter is that so far as the excursion business for April is concerned every line will take independent action and the whole affair is in considerable of a muddle.

Freight matters west of Chicago are really in no better shape than passenger, only that no open rupture has arisen. It is said that the new percentages are not working any better than the old ones, and that some of the members of the Western Trunk Lines Committee are getting tired of the way things are going and are more than likely to pull out and make a few tariffs for themselves. That the situation is regarded with apprehension by the officials of the association is evidenced by an attempt to convene the Executive Committee at St. Louis to-morrow, which, however, has failed, owing to the probable absence of the representative of one of the important roads.

The Canadian Pacific has made application to Chairman Caldwell to be relieved from its obligations to the clearing house for west-bound immigrant business at Boston so that it may meet the action of the Grand Trunk in increasing the commission on this class of business in retaliation for being ignored in the re-arrangement whereby the Canadian Pacific was allowed to pay commissions in territory in Canada competitive with the Grand Trunk. The Soo Line is also charged with paying a commission on prepaid European business out of all proportion to the agreed commission, eastbound.

Eastern lines have given official notice that the grain rate from Chicago to New York will be restored to 29 cents per 100 lbs. April 22.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines for the week ending April 13, amounted to 55,711 tons, against 60,614 tons during the preceding week, a decrease of 4,903 tons, and against 55,711 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	WEEK TO APRIL 13.		WEEK TO APRIL 6.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central.....	12,134	21.9	9,665	15.9
Wabash.....	2,935	5.3	6,818	11.3
Lake Shore & Mich. South.	5,316	9.6	6,200	10.2
Pitts., Ft. Wayne & Chicago	7,085	12.7	6,068	10.0
Pitts., Cin., Chi. & St. Louis.	4,948	8.9	4,273	7.1
Baltimore & Ohio.....	2,030	3.6	2,029	3.4
Chicago & Grand Trunk.....	8,710	15.6	9,155	15.1
New York, Chic. & St. Louis	3,779	6.8	3,875	6.4
Chicago & Erie.....	7,381	13.2	10,940	18.1
C., C., C. & St. Louis.....	1,563	2.4	1,541	2.5
Totals.....	55,711	100.0	60,614	100.0

Of the above shipments 4,305 tons were flour, 24,229 tons grain and mill stuff, 10,488 tons cured meats, 6,171 tons dressed beef, 1,211 tons butter, 1,257 tons hides and 6,396 tons lumber. The three Vanderbilt lines carried 38.3 per cent., the two Pennsylvania lines 21.6 per cent., lake lines took 1,209 tons.